

WO 00/50639

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3 of 12

Glycosidases	maltase-glucoamylase/alpha-glucosidase/MGAM	154360	NM_004668	Chr. 7
	lactase-phlorizin hydrolase/LPH/lactase/LCT	603202	NM_002299	2q21
	salivary amylase A/AMY1A	104700	NM_004038	1p21
	salivary amylase B/AMY1B	104701	*****	1p21
	salivary amylase C/AMY1C	104702	*****	1p22
	pancreatic amylase A/AMY2A	104650	X07057	1p21
	pancreatic amylase B/AMY2B	104660	*****	1p21
	dipeptidylpeptidase IV/CD26/ADA complexing protein 2/DPP4	102720	NM_001935	2q23
	pepsinogen A/PGA/PG	169700	AH001519	11q13
	pepsinogen, group 3/PGA3	169710	*****	11q13
	pepsinogen C/PGC	169740	J04443	6p21.3-p21.1
	kallikrein 1/KLK1	147910	AH002853	19q13.2-q13.4
	chymotrypsin-like protease	118888	X71875	16q22.1
	trypsinogen 1/TRY1/protease, serine 1/PRSS1	276000	NM_002769	7q35
	trypsinogen 1/TRY2/protease, serine 2/PRSS2	601564	NM_002770	7q35
	trypsinogen 1/TRY3/protease, serine 3/PRSS3	*****	NM_002771	*****
	enterokinase 1/TRY3/protease, serine 7/PRSS7	226200	NM_002772	21q21

Gastrointestinal Drug Metabolism	Enzymes and Peptidases	chymotrypsinogen I/CTRB1	118890	NM_001906	16q23.2-q23.3
		carboxypeptidase A1/CPA1	114850	NM_001868	7q32-qter
		carboxypeptidase A2/CPA2	600688	NM_001869	*****
		carboxypeptidase Z/CPZ	603105	NM_003652	
		elastase 1/ELA1	130120	D00158	12q13
		renal microsomal dipeptidase/DPEP1 (b-lactam ring hydrolysis)	179780	NM_004413	16q24.3
		tripeptidyl peptidase II/TPP2	190470	NM_003291	13q32-q33
		protease inhibitor 1/alpha-1-antitrypsin/AAT/PI	107400	NM_000295	14q32.1
		protease inhibitor/alpha-1-antichymotrypsin/AAC	107280	NM_001085	14q32.1
		protease inhibitor 1 (alpha-1-antitrypsin)-like/PIL	107410	NM_006220	14q32.1
Lipases	Carboxyl ester lipase (bile salt-stimulated lipase)/CEL	114840	M85201	9q34.3	
	Carboxyl ester lipase-like (bile salt-stimulated lipase-like)/CELL	114841	NM_001808	9q34.3	
	Pancreatic colipase/CLPS	120105	M95529	6pter-p21.1	
	Pancreatic triglyceride lipase/PNLIP	246600	AH003527	10q26.1	
	Lipoprotein lipase/LPL	238600	NM_000237	8p22	
	Hepatic triglyceride lipase/LIPC	151670	AH005429		

	<b>Oxidases</b>	salivary peroxidase/SAPX	170990	U39573	*****
		alcohol dehydrogenases 6/ADH6	103735	NM_000672	15q26
	<b>Esterases</b>	paraoxonase 2/PON2	602447	L48513	7q21.3
	<b>Phosphatases</b>	intestinal alkaline phosphatase/ALPI	171740	NM_001631	2q36.3-q37.1
		tissue non-specific alkaline phosphatase/liver alkaline phosphatase/ALPL	171760	NM_000478	1p36.1-p34
		serum albumin/ALB	103600	NM_000477	4q11-q13
	<b>Blood Transport</b>	alpha fetoprotein/AFP	104150	NM_001134	4q11-q13
		alpha albumin/afamin/AFM/ALB2	104145	NM_001133	4q11-q13
		vitamin D-binding protein/group-specific component/GC	139200	AH004448	4q12
		orosomucoid 1/alpha 1 acid glycoprotein/ORM1	138600	M13692	9q34.1-q34.3
		orosomucoid 2/alpha 1 acid glycoprotein, type 2/ORM2	138610	NM_000608	9q34.1-q34.3
		transthyretin (prealbumin, amyloidosis type I)/TTR	176300	NM_000371	18q11.2-q12.1
		thyroxin-binding globulin/TBG	314200	NM_000354	Xq22.2
		corticosteroid binding globulin precursor/CBG	122500	NM_001756	14q32.1
		sex hormone-binding globulin/SHBG	182205	X16349	17p13-p12
	<b>Drug Binding</b>				



	mannose-binding lectin, soluble/MBL2	154545	NM_00024 2	10q11.2- q21
Bile Acid Binders	Hepatic fatty acid binding protein/FABP1	134650	*****	2p11
	Intestinal fatty acid binding protein/FABP2	134640	NM_00013 4	4q28-q31
	Muscle fatty acid binding protein/mammary-derived growth inhibitor/MDGI/FABP3	134651	NM_00410 2	1p33-p31
	Adipocyte fatty acid binding protein/FABP4	600434	NM_00144 2	8q21
	Ileal fatty acid binding protein/FABP6	600422	U19869	5q23-q35
	Brain fatty acid binding protein/FABP7	602965	D88648	6q22-q23
	Adipocyte long chain fatty acid transport protein/FATP	600691	*****	*****
	Retina-specific ATP binding cassette transporter/ABCR	601691	NM_00035 0	1p21-p13
	ATP binding cassette 1/ABC1	600046	AJ012376	9q22-q31
	ATP binding cassette 2/ABC2	600047	U18235	9q34
	ATP binding cassette 3/ABC3	601615	NM_00108 9	16p13.3
	ATP binding cassette 7/ABC7	300135	AB005289	Xq13.1- q13.3
	ATP binding cassette 8/ABC8	603076	AF038175	21q22.3
	ATP-binding cassette 50/ABC50	603429	AF027302	6p21.33
	Placenta-specific ATP-binding cassette transporter/ABCP	603756	NM_00482 7	4q22

cystic fibrosis transmembrane conductance regulator/CFTR	602421	NM_000492	7q31.2
adrenoleukodystrophy/adrenomyeloneuropathy/ALD	300100	NM_000033	Xq28
adrenoleukodystrophy related protein/ALDR	601081	U28150	12q11-q12
sulfonylurea receptor (hyperinsulinemia)/SUR	600509	NM_000352	11p15.1
peroxisomal membrane protein 1/PXMP1	170995	NM_002858	1p22-p21
peroxisomal membrane protein 1-like/PXMP1L	603214	NM_005050	14q24.3
antigen peptide transporter 1/MHC 1/TAP1	170260	NM_000593	6p21.3
antigen peptide transporter 2/MHC 2/TAP2	170261	NM_000544	6p21.3
multidrug resistance associated protein MRP1	158343	L05628	16p13.1
multidrug resistance associated protein MRP2/CMOAT	601107	NM_000392	10q24
ATP-binding cassette, sub-family C (CFTR/MRP), member 3/CMOAT2	*****	NM_003786	*****
ATP-binding cassette, sub-family C (CFTR/MRP), member 4/MOATB	*****	NM_005845	*****
ATP-binding cassette, sub-family C (CFTR/MRP), member 5/SMRP	*****	NM_005688	*****
ATP-binding cassette, sub-family C (CFTR/MRP), member 9/SUR2	601439	NM_005691	*****

# ABC Transporters

Absorption and Distribution	multidrug resistance protein MDR1	171050	X96395	7q21.1
	multidrug resistance protein MDR3/P-glycoprotein 3/P-gly3	602347	X06181	7q21.1
	anthracycline resistance-related protein/ARA	603234	NM_001171	16p13.1
	bile salt export pump/BSEP	603201	NM_003742	2q24
	familial intrahepatic cholestasis 1/FIC1	602397	NM_005603	18q21
	Human sorcin/SRI	182520	L12387	7q21.1
	Solute carrier family 1, member 1/SLC1A1 (glutamate)	133550	U08989	9p24
	Solute carrier family 1, member 2/SLC1A2 (glutamate)	600300	U03505	11p13-p12
	Solute carrier family 1, member 3/SLC1A3 (glutamate)	600111	U03504	5p13
	Solute carrier family 1, member 4/SLC1A4 (glutamate)	600229	NM_003038	2p15-p13
	Solute carrier family 1, member 5/SLC1A5 (neutral AA)	109190	AF105230	19q13.3
	Solute carrier family 1, member 6/SLC1A6 (glutamate)	600637	NM_005071	*****
	Solute carrier family 2, member 1/SLC2A1/SGLT1 (glucose)	182380	NM_006516	22q13.1
	Solute carrier family 2, member 2/SLC2A2/GLUT2 (glucose)	138160	NM_006516	3q26.1-q26.3
	Solute carrier family 2, member 3/SLC2A3/GLUT3 (glucose)	138170	M20681	12p13.3

Solute carrier family 2, member 4/SLC2A4/GLUT4 (glucose)	138190	*****	17p13
Solute carrier family 2, member 5/SLC2A5/GLUT5 (glucose)	138230	NM_003039	1p36.2
Solute carrier family 3 member 1/SLC3A1 (aa transporter)	104614	*****	2p16.3
Solute carrier family 5 member 1/SLC5A2 (glucose)	182381	*****	16p11.2
Solute carrier family 5 member 3/SLC5A3 (myoinositol)	600444	L38500	21q22
Solute carrier family 5 member 6/SLC5A6 (folate, biotin, lipoate)	604024	*****	2p23
Solute carrier family 6 member 1/SLC6A1 (GABA)	137165	X54673	3p25-p24
Solute carrier family 6 member 2/SLC6A2 (noradrenalin)	163970	NM_001043	16q12.2
Solute carrier family 6 member 3/SLC6A3 (dopamine)	126455	L24178	5p15.3
Solute carrier family 6 member 4/SLC6A4 (serotonin)	182138	X70697	17q11.1-q12
Solute carrier family 6, member 5/SLC6A5 (glycine)	604159	NM_004211	*****
Solute carrier family 6, member 6/SLC6A6 (taurine)	186854	U16120	3p25-q24
Solute carrier family 6, member 8/SLC6A8 (creatine)	300036	NM_005629	300036
Solute carrier family 6, member 9/SLC6A9 (glycine)	601019	S70612	1p33

Drug Uptake

Solute carrier family 6, member 10/SLC6A10 (creatine-testis)	601294	*****	16p11.2
Solute carrier family 6, member 12/SLC6A12 (GABA-betaine)	603080	NM_00304_4	12p13
Solute carrier family 7, member 1/SLC7A1 (cationic AA)	104615	*****	13q12.3
Solute carrier family 7, member 2/SLC7A2 (cationic AA)	601872	D29990	8p22
Solute carrier family 7, member 4/SLC7A4 (cationic AA)	603752	*****	22q11.2
Solute carrier family 7, member 5/SLC7A5 (neutral AA)	600182	M80244	16q24.3
Solute carrier family 7, member 7/SLC7A7 (dibasic AA)	603593	Y18474	14q11.2
Solute carrier family 7, member 9/SLC7A9 (neutral AA)	604144	*****	19q13.1
Solute carrier family 10, member 1/SLC10A1 (taurocholate)	182396	NM_00304_9	chr. 14
Solute carrier family 10, member 2/SLC10A2 (taurocholate)	601295	NM_00045_2	13q33
Solute carrier family 11, member 1/SLC11A1 (?)	600266	AH002806	2q35
Solute carrier family 11, member 2/SLC11A2 (iron)	600523	L37347	12q13
Solute carrier family 13, member 2/SLC13A2 (dicarboxylic acids)	604148	NM_00398_4	17p11.1-q11.1
Solute carrier family 14, member 1/SLC14A1 (urea)	111000	*****	18q11-q12

Solute  
Antiporters

Solute carrier family 14, member 2/SLC14A2 (urea)	601611	X96969	18q12.1-q21.1
Solute carrier family 15, member 1/SLC15A1 (peptides)	600544	U13173	13q33-q34
Solute carrier family 15, member 2/SLC15A2 (peptides)	602339	S78203	*****
Solute carrier family 16, member 1/SLC16A1 (monocarboxylic acids)	600682	NM_003051	1p13.2-p12
Solute carrier family 16, member 2/SLC16A2 (monocarboxylic acids)	300095	NM_006517	Xq13.2
Solute carrier family 16, member 3/SLC16A3 (monocarboxylic acids)	603877	NM_004207	*****
Solute carrier family 16, member 4/SLC16A4 (monocarboxylic acids)	603878	*****	*****
Solute carrier family 16, member 5/SLC16A5 (monocarboxylic acids)	603879	NM_004695	*****
Solute carrier family 16, member 6/SLC16A6 (monocarboxylic acids)	603880	NM_004694	*****
Solute carrier family 16, member 7/SLC16A7 (monocarboxylic acids)	603654	AF049608	12q13
Solute carrier family 18, member 1/AT1/SLC18A1 (monoamines)	193001	L09118	10q25
Solute carrier family 18, member 2/AT2/SLC18A2 (monoamines)	193002	*****	8p21.3
Solute carrier family 18, member 3/AT3/SLC18A3 (monoamines)	600336	NM_003055	10q11.2
Solute carrier family 19, member 1/SLC19A1 (reduced folate)	600424	U19720	21q22.3

Solute carrier family 19, member 2/SLC19A2 (thiamine)	603941	AF160186	1q23.2-q23.3
Solute carrier family 21, member 2/SLC21A2 (prostaglandin)	601460	NM_005630	3q21
Solute carrier family 21, member 3/SLC21A3 (organic anion)	602883	NM_005075	12p12
Solute carrier family 22, member 1/SLC22A1 (organic cation)	602607	NM_003058	6q26
Solute carrier family 22, member 1-like/SLC22A1L (organic cation)	602631	AF037064	11p15.5
Solute carrier family 22, member 2/SLC22A2 (organic cation)	602608	NM_003058	6q26
Solute carrier family 22, member 4/SLC22A4 (organic cation)	604190	NM_003059	Chr. 5
Solute carrier family 22, member 5/SLC22A5 (carnitine)	603377	NM_003060	5q33.1
Solute carrier family 25, member 1/SLC25A1 (tricarboxylic acids) (mitochondrial)	190315	X96924	22q11
Solute carrier family 25, member 11/SLC25A11 (oxoglutarate/malate) (mitochondrial)	604165	NM_003562	17p13.3
Solute carrier family 25, member 12/SLC25A12 (?) (mitochondrial)	603667	NM_003705	*****
Solute carrier family 25, member 13/SLC25A13 (?) (mitochondrial)	603859	*****	7q21.3

Solute carrier family 25, member 15/SLC25A15 (ornithine) (mitochondrial)	603861	*****	13q14
Solute carrier family 25, member 16/SLC25A16 (ADP/ATP) (mitochondrial)	139080	M31659	10q21.3-q22.1
Solute carrier family 29, member 1/SLC29A1/ENT1 (nucleoside) (mitochondrial)	602193	NM_004955	6p21.2-p21.1
Solute carrier family 29, member 2/SLC29A2/ENT2 (nucleoside) (mitochondrial)	602110	X86681	11q13
Aryl hydrocarbon receptor nuclear translocator/ARNT	126110	NM_001668	1q21
Aryl hydrocarbon receptor nuclear translocator-like/ARNTL	602550	NM_001178	11p15
Aryl hydrocarbon receptor/AHR	600253	NM_001621	7p15
Nuclear receptor subfamily 1, group I, member 2/NR1I2	603065	NM_003889	*****
Constitutive androstane receptor, beta/orphan nuclear hormone receptor/CAR	603881	NM_005122	*****
Nuclear receptor subfamily 1, group H, member 2/NR1H2	600380	U07132	19q13.3
Retinoic acid receptor, alpha/RARA	180240	NM_000964	17q12
Retinoic acid receptor, beta/RARB	180220	NM_000965	3p24



Retinoic acid receptor, gamma/RARG	180190	M57707	12q13
Retinoid X receptor alpha/RXRA	180245	NM_005693	9q34.3
Retinoid X receptor beta/RXRB	180246	X66424	6p21.3
Retinoid X receptor gamma/RXRG	180247	U38480	1q22-q23
RAR-related orphan receptor A/RORA	600825	NM_002943	15q21-q22
RAR-related orphan receptor B/RORB	600825	*****	15q21-q22
RAR-related orphan receptor C/RORC	602943	NM_005060	1q21
cellular retinoic acid-binding protein, type 2/CRABP2	180231	*****	1q21.3
glucocorticoid receptor/GRL	138040	NM_000176	5q31
Peroxisome proliferative activated receptor, alpha/PPARA	170998	NM_005036	22q12-q13.1
Peroxisome proliferative activated receptor, gamma/PPARG	601487	NM_005037	3p25
Peroxisome proliferative activated receptor, delta/PPARD	6E+05	NM_006238	1q21.3
cytochrome P450, subfamily I, polypeptide 1 (aryl hydrocarbon oxidase)/CYP1A1	108330	NM_000499	15q22-q24
cytochrome P450, subfamily I, polypeptide 2 (phenacetin metabolism)/CYP1A2	124060	AH002667	15q22-qter
cytochrome P450, subfamily IB, polypeptide 1 (dioxin inducible)/CYP1B1	601771	NM_000104	2p22-p21

cytochrome P450, subfamily II, polypeptide 1 (phenobarbital inducible)/CYP2A	123960	X13897	19q13.2
cytochrome P450, subfamily IIA, polypeptide 6 (coumarin-7- hydroxylase)/CYP2A6	122720	NM_00076 2	19q13.2
cytochrome P450, subfamily IIB (phenobarbital inducible)/CYP2B	123930	M29874	19q13.2
cytochrome P450, subfamily IIC, polypeptide 8/CYP2C8	601129	*****	10q24
cytochrome P450, subfamily IIC, polypeptide 9 (hydroxylation of tolbutamide)/CYP2C9	601130	*****	10q24
cytochrome P450, subfamily IIC, polypeptide 18/CYP2C18	601131	*****	10q25
cytochrome P450, subfamily IIC, polypeptide 19 (mephenytoin 4- hydroxylase)/CYP2C19	124020	NM_00076 9	10q24.1- q24.3
cytochrome P450, subfamily IID, polypeptide 6 (debrisoquine hydroxylation)/CYP2D6	124030	NM_00010 6	22q13.1
cytochrome P450, subfamily IIE (ethanol inducible)/CYP2E	124040	J02843	10q24.3- qter
cytochrome P450, subfamily IIF (ethoxycoumarin monooxygenase), polypeptide 1/CYP2F1	124070	NM_00077 4	19q13.2
cytochrome P450, subfamily IIJ (arachidonate epooxygenase), polypeptide 2/CYP2J2	601258	NM_00077 5	1p31.3- p31.2

## P450

Cytochromes  
and  
Regulatory  
FactorsCytochrome  
P450s

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cytochrome P450, subfamily IIIA (nephedipine oxidase), polypeptide 3/CYP3A4	124010	NM_000776	7q22.1
cytochrome P450, subfamily IVA (fatty acid W-hydroxylase), polypeptide 11/CYP4A11	601310	NM_000778	Chr.1
cytochrome P450, subfamily IVB, polypeptide 1/CYP4B1	124075	NM_000779	1p34-p12
cytochrome P450, subfamily IVF (leukotriene B4-W-hydroxylase), polypeptide 3/CYP4F3	601270	NM_000896	19p13.2
cytochrome P450, subfamily VIIA (cholesterol 7-a-hydroxylase), polypeptide 1/CYP7A1	118455	M89803	8q11-q12
cytochrome P450, subfamily VIIB (oxysterol 7-a-hydroxylase), polypeptide 1/CYP7B1	603711	AF029403	8q21.3
cytochrome P450, subfamily VIIB (sterol 12-a-hydroxylase), polypeptide 1/CYP8B1	602172	*****	3p21.3-p22
cytochrome P450, subfamily XIA (cholesterol side-chain cleavage)/CYP11A	118485	NM_000781	15q23-q24
cytochrome P450, subfamily XIB, polypeptide 2 (steroid 11-b-hydroxylase)/CYP11B2	124080	NM_000498	8q21
cytochrome P450, subfamily XIX (androgen aromatase)/CYP19	107910	NM_000103	15q21.1
cytochrome P450, subfamily XXI (sterol 21-a-hydroxylase)/CYP21	201910	M13936	6p21.3

Phase I Drug Metabolism (oxidation and			cytochrome P450, subfamily XXIV (25-hydroxyvitamin D 24-hydroxylase)/CYP24	600125	S67623	20q13.2-q13.3
			cytochrome P450, subfamily XXVIA, polypeptide 1 (retinoic acid hydroxylase)/CYP26A1	602239	NM_000783	10q23-q24
			cytochrome P450, subfamily XXVIA, polypeptide 1 (25-hydroxyvitamin D-1-a-hydroxylase)/CYP27A1	213700	NM_000105	2q33-qter
			adrenodoxin/ferredoxin 1/FDX1/ADX	103260	NM_004109	11q22
			adrenodoxin reductase/ferredoxin:NADP(+) reductase/FDXR/ADX	103270	NM_004110	17q24-q25
			cytochrome P450, subfamily XXVIB, polypeptide 1 (25-hydroxyvitamin D-1-a-hydroxylase)/CYP27B1	264700	NM_000785	12q14
			cytochrome P450, subfamily XLVI (cholesterol 24-hydroxylase)/CYP46	604087	NM_006668	14q32.1
			cytochrome P450, subfamily LI (lanosterol 14-a-demethylase)/CYP51	601637	U51692	7q21.2-q21.3
		Cofactor Synthesis	heme synthase	603707	AJ224328	6p21.3
			heme synthase	603708	*****	5q11
		Alcohol	alcohol dehydrogenases 1, alpha subunit/ADH1	103700	NM_000667	4q22
			alcohol dehydrogenases 2, beta subunit/ADH2	103720	NM_000668	4q22
			alcohol dehydrogenases 3, gamma subunit/ADH3	103730	M12272	4q22

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Dehydrogenases	alcohol dehydrogenases 4/pi isozyme/ADH4	103740	M15943	4q22
	alcohol dehydrogenases 5/chi isozyme/ADH5	103710	NM_000671	4q21-q25
	alcohol dehydrogenases 6/ADH6	103735	NM_000672	15q26
	alcohol dehydrogenases 7/ADH7	600086	AH006682	4q23-q24
	aldehyde dehydrogenase 1/ALDH1 (liver cytosol)	100640	AH002598	9q21
Aldehyde Dehydrogenases	aldehyde dehydrogenase 2/ALDH2 (liver mitochondria)	100650	K03001	12q24.2
	3/acetaldehyde dehydrogenase	100660	M74542	17p11.2
	5/acetaldehyde dehydrogenase	100670	NM_000692	9p13
	aldehyde dehydrogenase 5, member A1/succinic semialdehyde dehydrogenase/ALDH5A1	271980	NM_001080	6p22
	6/acetaldehyde dehydrogenase	600463	NM_000693	15q26
	7/acetaldehyde dehydrogenase	600466	NM_000694	11q13
	aldehyde dehydrogenase 8/ALDH8	601917	NM_000695	chr. 11
	aldehyde dehydrogenase 9/g-aminobutyraldehyde dehydrogenase/ALDH9	602733	NM_000696	1q22-q23
	aldehyde dehydrogenase 10/ALDH10	270200	NM_000382	17p11.2
Pyridine Nucleotide-Linked Oxidoreductases				

Aldo-Keto Reductases	Aldo-keto reductase family 1, member A1/dihydrodiol dehydrogenase/AKR1A1	103830	NM_00606 6	1p33-p32
	Aldo-keto reductase family 1, member C1/dihydrodiol dehydrogenase/AKR1C1	600449	NM_00135 3	10p15-p14
	Aldo-keto reductase family 1, member C3/dihydrodiol dehydrogenase/AKR1C3	603966	NM_00373 9	10p15-p14
	Aldo-keto reductase family 1, member C4/chlorodecone reductase/AKR1C4	600451	*****	10p15-p14
	Aldo-keto reductase family 7, member A2/aflatoxin aldehyde reductase/AKR7A2	603418	NM_00368 9	*****
	Carbonyl reductase 1/CBR1	114830	NM_00175 7	21q22.12
	Carbonyl reductase 2/CBR2	*****	*****	chr. 11
	Carbonyl reductase 3/CBR3	603608	NM_00123 6	21q22.2
	Sepiapterin reductase (7,8- dihydrobiopterin:NADP+ oxidoreductase)/SPR	182125	NM_00312 4	2p14-p12
	Z-crystallin/quinone reductase/CRYZ	123691	L31521	1p31-p22
Quinone Oxidoreductases	Z-crystallin-like/quinone reductase- like/CRYZL1	603920	NM_00511 1	21q22.1
	NAD(P)H menadione oxidoreductase 1, dioxin- inducible/NMOR1/diaphorase 4/DIA4	125860	NM_00090 3	16q22.1

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Fatty Acid $\beta$ -Oxidation	Peroxisome Synthesis	peroxisomal membrane protein 3 (35kd)	170993	NM_000318	8q21.1
		peroxisomal biogenesis factor 3/PEX3	603164	NM_003630	*****
		peroxisomal biogenesis factor 6/PEX6	601498	NM_000287	6p21.1
		peroxisomal biogenesis factor 7/PEX7	601757	NM_000288	6q22-q24
		peroxisomal biogenesis factor 10/PEX10	602859	*****	*****
		peroxisomal biogenesis factor 11A/PEX11A	603866	NM_003847	*****
		peroxisomal biogenesis factor 11B/PEX11B	603867	NM_003846	*****
		peroxisomal biogenesis factor 12/PEX12	601758	NM_000286	
		peroxisomal biogenesis factor 13/PEX13	601789	U71374	2p15
		peroxisomal biogenesis factor 14/PEX14	601791	*****	*****
Coenzyme A Ligases		peroxisomal farnesylated protein/PXFP	600279	NM_002857	1q22
		Fatty acid CoA Ligase, long chain 1/FACL1	152425	*****	3q13
		Fatty acid CoA Ligase, long chain 2/FACL2	152426	*****	4q34-q35
		Fatty acid CoA Ligase, long chain 3/FACL3	602371	NM_004457	2q34-q35
		Fatty acid CoA Ligase, long chain 4/FACL4	300157	NM_004458	Xq22.3
		Fatty acid CoA Ligase, very long chain 1/FACVL1	603247	*****	15q21.2
		Enoyl-CoA, hydratase/3-hydroxyacyl CoA dehydrogenase/EHHADH	261515	NM_001966	3q27
		hydroxyacyl-CoA dehydrogenase/3-ketoacyl-CoA thiolase/enoyl-CoA hydratase, alpha subunit/HADHA	600890	NM_000182	2p23
		hydroxyacyl-CoA dehydrogenase/3-ketoacyl-CoA thiolase/enoyl-CoA hydratase, beta subunit/HADHB	143450	NM_000183	2p23



Oxidation	acyl-Coenzyme A oxidase 1/ACOX1 (peroxisomal)	264470	NM_004035	17q25
	acyl-Coenzyme A oxidase 2, branched chain/ACOX2 (peroxisomal)	601641	NM_003500	3p14.3
	acyl-Coenzyme A dehydrogenase, C-2 to C-3 short chain precursor/ACADS (mitochondrial)	201470	NM_000017	12q22-qter
	acyl-Coenzyme A dehydrogenase, C-4 to C-12 straight chain/ACADM (mitochondrial)	201450	NM_000016	1p31
	acyl-Coenzyme A dehydrogenase, long chain/ACADL (mitochondrial)	201460	NM_001608	2q34-q35
	hydroxyacyl-Coenzyme A dehydrogenase, type II/HADH2	602057	NM_004493	*****
	enoyl-Coenzyme A hydratase 1/ECH1 (peroxisomal)	600696	NM_001398	19q13
	3-prime-phosphoadenosine 5-prime-phosphosulfate synthase 1/PAPSS1	603262	NM_005443	4q
	Phenol-preferring sulfotransferase, family 1A, member 1/SULT1A1	171150	NM_001055	16p12.1-p11.2
	Phenol-preferring sulfotransferase, family 1A, member 2/SULT1A2	601292	NM_001054	16p12.1-p11.2
Sulfate Unit Activation	Phenol-preferring sulfotransferase, family 1A, member 3/SULT1A3	600641	L19956	16p11.2
	Sulfotransferase, family 1C, member 3/SULT1C1	602385	U66036	2q11.1-q11.2
	Dehydroepiandrosterone (DHEA)-preferring sulfotransferase, family 2A, member 1/SULT2A1	125263	NM_003167	19q13.3

Sulfation	Sulfotransferase, family 2B, member 1/SULT2B1	604125	NM_004605	19q13.3
	Estrogen-prefering sulfotransferase/STE	600043	NM_005420	4q13.1
	N-deacetylase/N-sulfotransferase (heparan glucosaminyl)/NDST1	600853	U18918	5q32-q33.3
	N-deacetylase/N-sulfotransferase (heparan glucosaminyl)/NDST2	603268	NM_003635	10q22
	N-deacetylase/N-sulfotransferase (heparan glucosaminyl)/NDST3	603950	NM_004784	*****
	Carbohydrate sulfotransferase 1 (chondroitin 6/keratan)/CHST1	603797	NM_003654	11p11.2-p11.1
	Carbohydrate sulfotransferase 2 (chondroitin 6/keratan)/CHST2	603798	*****	7q31
	Carbohydrate sulfotransferase 3 (chondroitin 6/keratan)/CHST3	603799	NM_004273	*****
	Cerebroside sulfotransferase (3'-phosphoadenylylsulfate:galactosylceramide 3'')/CST	602300	NM_004861	*****
	Heparan sulfate (glucosamine) 3-O-sulfotransferase 1/HS3ST1	603244	NM_005114	*****
	Heparan sulfate (glucosamine) 3-O-sulfotransferase 2/HS3ST2	604056	NM_006043	16p12
	Heparan sulfate (glucosamine) 3-O-sulfotransferase 3A1/HS3ST3A1	604057	NM_006042	17p12-p11.2
	Heparan sulfate (glucosamine) 3-O-sulfotransferase 3B1/HS3ST3B1	604058	NM_006041	17p12-p11.2
	Heparan sulfate (glucosamine) 3-O-sulfotransferase 4/HS3ST4	604059	AF105378	16p11.2

Sulphydrylation	Methylguanidine methyltransferase (O6-alkylguanidine detoxification)	156569	M29971	10q26
	thiotransferase/rhodanese/TST (alkylguanidine detoxification)	180370	D87292	22q11.2-qter
UDP-Glycosyltransferases	UDP glycosyltransferase 1/UGT1	191740	NM_001072	Chr. 12
	UDP glycosyltransferase family 2, member B4/UGT2B4	600067	NM_001073	4q13
	UDP glycosyltransferase family 2, member B7/UGT2B7	600068	NM_001074	1q14
	UDP glycosyltransferase family 2, member B10/UGT2B10	600070	NM_001075	*****
	UDP glycosyltransferase family 2, member B15/UGT2B15	600069	U06641	4q13
	UDP glycosyltransferase family 2, member B17/UGT2B17	601903	NM_001077	1q14
	UDP glycosyltransferase 8/UGT8	601291	U30930	4q26
	UDP-glucuronosyltransferase	218800	AJ005162	Chr.2
	methionine adenosyltransferase I, alpha/MAT1A	250850	NM_000429	10q22
	methionine adenosyltransferase II, alpha/MAT2A	601468	NM_005911	2p11.2
Carbon Unit Activation for SAM	Folate Receptor Alpha/FOLR1	136430	M28099	1q13.3-q13.5
	Folate Receptor Beta/FOLR2	136425	AF000380	1q13.3-q13.5
	Folate Receptor Gamma/FOLR3	602469	Z32564	*****
	Folate Transporter (SLC19A1)	600424	U19720	21q22.3
	Vitamin B12 binding protein	275350	NM_000355	22q11.2-qter
	folylpolyglutamate synthetase/PPGS	136510	M98045	9cen-q34
	gamma-glutamyl hydrolase/GGH	601509	U55206	*****

Conjugation	Carbon Unit Activation for Folate	Methylenetetrahydrofolate reductase/MTHFR	236250	U09806	1p36.3
		Dihydrofolate reductase/DHFR	126060	J00140	5q11.2-q13.2
		5,10-methylenetetrahydrofolate dehydrogenase, 5,10-			
		methylenetetrahydrofolate cyclohydrolase, 10-			
		formyltetrahydrofolate synthetase/MTHFD1	172460	NM_005956	14q24
		5,10-methylenetetrahydrofolate synthetase (5-formyltetrahydrofolate cyclo-ligase)/MTHFS	604197	NM_006441	Chr. 15
		phosphoribosylglycinamide formyltransferase, phosphoribosylglycinamide synthetase,			
		phosphoribosylaminoimidazole folate hydrolase 1/FOH1	138440	NM_000819	21q22.1
		6-pyruvoyl tetrahydrobiopterin synthase/PTPS	600934	NP_004467	11q14
		serine hydroxymethyltransferase 1 (soluble)/SHMT1	261640	Q03393	1q22.3-q23.2
		serine hydroxymethyltransferase 2 (mitochondrial)/SHMT2	182144	NM_004169	17p11.2
		Glycine aminotransferase/glycine cleavage T protein/GAT	138450	NM_005412	12q13
		5-methylenetetrahydrofolate- homocysteine	238310	NM_000481	3p21.2-p21.1
		methylenetetrahydrofolate- homocysteine			
		methylenetetrahydrofolate- homocysteine	156570	NM_000254	1q43

Phase II Drug Metabolism (conjugation and catabolism)	glutamate formiminotransferase/dihydrofolate synthetase	229100	*****	*****
	catechol-O-methyltransferase/COMT	116790	NM_00075_4	22q11.2
	phenylethanolamine N- methyltransferase/PNMT	171190	NM_00268_6	17q21-q22
	nicotinamide N- methyltransferase/NNMT	600008	NM_00616_9	11q23.1
	Thiopurine methyltransferase (6- mercaptopurine detoxification)	187680	U12387	6p22.3
	pyruvate dehydrogenase E1-alpha subunit/PDHA1	312170	L48690	Xp22.2- p22.1
	pyruvate dehydrogenase (lipoamide) beta/PDHB	179060	NM_00092_5	3p13-q23
	pyruvate dehydrogenase complex, lipoyl-containing component X/E3- binding protein/PDX1	245349	NM_00347_7	11p13
	pyruvate dehydrogenase complex E3 subunit/DLD	246900	NM_00010_8	7q31-q32
	sterol-O-acyl transferase 1/SOAT1	102642	L21934	1q25
	sterol-O-acyl transferase 2/SOAT2	601311	*****	chr. 12
	N-acetyltransferase 1/arylamine acetylase 1/NAT1	108345	NM_00066_2	8p23.1- p21.3
	N-acetyltransferase 2/arylamine acetylase 2/NAT2	243400	NM_00001_5	8p23.1- p21.3
	cystathionine-beta-synthase/CBS	236200	NM_00007_1	21q22.3

Glutathione Synthesis	cystathionase/cystathionine gamma-lyase/CTH	219500	NM_001902	Chr.16
	glutamate-cysteine ligase (gamma-glutamylcysteine synthetase), catalytic (72.8kD)/GLCLC	230450	NM_001498	6p12
	glutamate-cysteine ligase (gamma-glutamylcysteine synthetase), regulatory (30.8kD)/GLCLR	601176	NM_002061	1p22.1
	glutathione synthetase/GSS	601002	NM_000178	20q11.2
	Glutathione-S-transferase 6	138391	*****	*****
Glutathione Transferase	Glutathione-S-transferase, alpha 1/GSTA1	138359	L13269	6p12.2
	Glutathione-S-transferase, alpha 2/GSTA2	138360	M15872	6p12.2
	Glutathione-S-transferase, kappa 1/GSTK1	602321	*****	*****
	Glutathione-S-transferase 1/MGST1 (microsomal)	138330	AH003674	Chr.12
	Glutathione-S-transferase 2/MGST2 (microsomal)	601733	NM_002413	4q28-q31
	Glutathione-S-transferase, mu 1-like/GSTM1L	138270	*****	Chr. 3
	Glutathione-S-transferase, mu 1/GSTM1	138350	J03817	1p13.3
	Glutathione-S-transferase, mu 2/GSTM2 (muscle)	138380	NM_000848	1p13.3
	Glutathione-S-transferase, mu 3/GSTM3 (brain)	138390	NM_000849	1p13.3
	Glutathione-S-transferase, mu 4/GSTM4	138333	NM_000850	1p13.3

	Glutathione-S-transferase, mu 5/GSTM5 (brain/lung)	138385	NM_000851	1p13.3
	Glutathione-S-transferase, pi/GSTP1	134660	NM_000852	11q13
	Glutathione-S-transferase, theta 1/GSTT1	600436	NM_000853	22q11.2
	Glutathione-S-transferase, theta 2/GSTT2	600437	NM_000854	22q11.3
	Glutathione-S-transferase, zeta 1/maleylacetate isomerase/MAAI/GSTZ1	603758	NM_001513	14q24.3
$\gamma$ -Glutamyltranspeptidase	Gamma-glutamyltranspeptidase 1/GGT1	231950	J04131	22q11.1-q11.2
	Gamma-glutamyltranspeptidase 2/GGT2	137181	AH002728	22q11.1
Esterases	Gamma-glutamyltransferase-like activity 1/GGTLA1	137168	NM_004121	*****
	paraoxonase 1/PON1 (arylesterase)	168820	AH004193	7q21.3
	paraoxonase 2/PON2	602447	L48513	7q21.3
	paraoxonase 3/PON3	602720	L48516	7q21.4
	esterase C/ESC (acetyl esterase)	133270	*****	*****
	esterase A4/ESA4	133220	*****	11q13-q22
	esterase B/buteryl esterase/ESB (erythrocyte)	133260	*****	*****
	esterase B3/ESB3	133290	*****	Chr.16
	esterase A5/A7/acetyl esterase/ESA5/ESA7 (brain)	133230	*****	*****
	acetylcholinesterase/ACHE	100740	M55040	7q22

Hydratases and Lyases	butyrylcholinesterase 1/serum cholinesterase 1/BCHE1	177400	NM_0000553	26.1-q26.2
	butyrylcholinesterase 2/serum cholinesterase 2/BCHE2	177500	*****	2q33-q35
	egasym/esterase 22	129905	AF177775	*****
	neuropathy target esterase/NTE	603197	NM_006702	19p
	carboxylesterase 1/serine esterase/CES1 (hepatic)	114835	NM_001266	16q13-q22.1
	arylacetamide deacetylase/AADAC	600338	NM_001086	3q21.3-q25.2
	acyl-CoA thioester hydrolase 1, long chain/acyl-CoA thioesterase 1/ACT1	602586	*****	*****
	acyl-CoA thioester hydrolase 2, long chain/acyl-CoA thioesterase 2/ACT2	602587	*****	*****
	esterase D/ESD	133280	M13450	13q14.11
	hydroxyacyl glutathione hydrolase; glyoxalase 2/HAGH	138760	NM_005326	16p13
Thioesterase	esterase D/S-formylglutathion hydrolase/ESC (thioesterase)	133280	M13450	13q14.11
Amidase	aminoacylase 1/ACY1	104620	NM_000666	3p21.1
	aminoacylase 2/ACY2/aspartoacylase (Canavan disease)/ASPA	271900	NM_0000049	17pter-p13
	fatty acid amide hydrolase/FAAH	602935	NM_001441	1p34-p35
Epoxide Hydratases	epoxide hydrolase 1/EPHX1 (microsomal)	132810	NM_000120	1p11-qter
	epoxide hydrolase 2/EPHX2	132811	*****	8p21-p12
Proteases	bleomycin hydrolase/BLMH	602403	NM_000386	17q11.2



Transporters	Multidrug resistance protein MDR3/P-glycoprotein 3/PGY3	602347	X06181	7q21.1
	Familial intrahepatic cholestasis 1, (progressive, Byler disease and benign recurrent) /FIC1	602397	NM_005603	18q21
	Bile salt export pump/BSEP	603201	NM_003742	2q24
	Microsomal triglyceride transfer protein large subunit/MTP	157147	NM_000253	4q22-q24
	Solute carrier family 6, member 6/SLC6A6 (taurine)	186854	U16120	3p25-q24
	Solute carrier family 10, member 1/SLC10A1 (taurocholate)	182396	NM_003049	chr. 14
	Solute carrier family 10, member 2/SLC10A2 (taurocholate)	601295	NM_000452	13q33
	Solute carrier family 13, member 2/SLC13A2 (dicarboxylic acids)	604148	NM_003984	17p11.1-q11.1
	Solute carrier family 19, member 1/SLC19A1 (reduced folate)	600424	U19720	21q22.3
	Solute carrier family 21, member 3/SLC21A3 (organic anion)	602883	NM_005075	12p12
	Solute carrier family 22, member 1/SLC22A2 (organic cation)	602607	NM_003058	6q26
	multidrug resistance protein MDR1	171050	X96395	7q21.1
	multidrug resistance associated protein MRP2/CMOAT	601107	NM_000392	10q24
	multidrug resistance protein MDR3/P-glycoprotein 3/PGY3	602347	X06181	7q21.1

Canalicular Uptake and Concentration	Bile Salt Synthesis	Bile acid Coenzyme A: amino acid N-acyltransferase (glycine N-choloyltransferase)/BAAT	602938	NM_001701	9q22.3
		cytochrome P450, subfamily XLVI (cholesterol 24-hydroxylase)/CYP46	604087	NM_006668	14q32.1
		cytochrome P450, subfamily VIIA (cholesterol 7- $\alpha$ -hydroxylase), polypeptide 1/CYP7A1	118455	M89803	8q11-q12
		cytochrome P450, subfamily VIIB (cholesterol 7- $\alpha$ -hydroxylase), polypeptide 1/CYP7B1	603711	AF029403	8q21.3
	Bile	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, alpha 1 polypeptide/ATP1A1	182310	NM_000701	1p13-p11
		ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, alpha 1 polypeptide-like/ATP1A1L	182360	NM_001676	13q12.1-q12.3
		ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, alpha 2 polypeptide/ATP1A2	182340	NM_000702	1q21-q23
		ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 1 polypeptide/ATP1B1	182330	NM_001677	1q22-q25
		ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 2 polypeptide/ATP1B2	182331	X16645	17p
		ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 3 polypeptide/ATP1B3	601867	NM_001679	3q22-q23
		solute carrier family 4, bicarbonate/chloride anion exchanger, member 1/SLC4A1	109270	NM_000342	17q21-q22
		solute carrier family 4, sodium bicarbonate cotransporter, member 4/SLC4A4	603345	NM_003759	4q21

Concentration	solute carrier family 4, sodium bicarbonate cotransporter, member 5/SLC4A5	603318	NM_003788	4q21
	Solute carrier family 9, member A2/SLC9A2 (sodium/hydrogen ion)	600530	NM_003048	2q11.2
	Solute carrier family 9, member A3/SLC9A3 (sodium/hydrogen ion)	182307	*****	5p15.3
	chloride channel 5/CLCN5	300008	NM_000084	Xp11.22
	chloride channel, calcium activated, family member 1/CLCA1	603906	NM_001285	1p31-p22
	chloride channel, calcium activated, family member 2/CLCA2	604003	NM_006536	*****
	cystic fibrosis transmembrane conductance regulator/CFTR	602421	NM_000492	7q31.2
	aquaporin 1/AQP1	107776	NM_000385	7p14
	aquaporin 3/AQP3	600170	NM_004925	9p13
	Cholecystokinin/CCK	118440	L00354	3pter-p21
Bile Secretion	Cholecystokinin A receptor/CCKAR	118444	L13605	4p15.2-p15.1
	Cholecystokinin B receptor/CCKBR	118445	L08112	11p15.5-p15
	Cytoplasmic Cysteine conjugate beta lyase/glutamine transaminase 1/CCL1	600547	NM_004059	Chr.9
	renal microsomal dipeptidase/DPEP1	179780	NM_004413	16q24.3
	alanyl (microsomal) aminopeptidase/aminopeptidase M/ANPEP	151530	NM_001150	15q25-q26

Excretion	Hydratases and Lyases	Galactosaminic (N-acetyl)-D-sulfate sulfatase (Morquio syndrome)/GALNS	253000	NM_000512	16q24.3
		Iduronate-2-sulfatase (Hunter syndrome)/IDS	309900	NM_000202	Xq28
		Arylsulfatase A/steroid sulfatase/ARSA	250100	NM_000487	22q13.31-qter
		Arylsulfatase B/steroid sulfatase/ARSB	253200	NM_000046	5q11-q13
		Arylsulfatase C, isozyme s/steroid sulfatase/ARCSI	308100	NM_000351	Xp22.32
		Arylsulfatase D/steroid sulfatase/ARSD	300002	*****	Xp22.3
		Arylsulfatase E/steroid sulfatase/ARSE	300180	NM_000047	Xp22.3
		Arylsulfatase F/steroid sulfatase/ARSF	300003	NM_004042	Xp22.3
		glucuronidase, beta/GUSB	253220	NM_000181	7q21.11
		renal transport of beta-amino acids/AABT	109660	*****	Chr.21
Uptake and Transport		Solute carrier family 3 member 1/SLC3A1 (aa transporter)	104614	*****	2p16.3
		Solute carrier family 5 member 2/SLC5A5 (Na/glucose transporter)	182381	A56765	16p11.2
		Solute carrier family 6, member 6/SLC6A6 (taurine)	186854	U16120	3p25-q24
		Solute carrier family 7, member 9/SLC7A9 (neutral AA)	604144	*****	19q13.1
		Solute carrier family 13, member 2/SLC13A2 (dicarboxylic acids)	604148	NM_003984	17p11.1-q11.1

Renal Tubular Uptake and Concentration	Acidosis	solute carrier family 17 (sodium phosphate), member 1/SLC17A1	182308	NM_005074	6p23-p21.3
		Solute carrier family 22, member 1/SLC22A2 (organic cation)	602607	NM_003058	6q26
		Solute carrier family 22, member 1-like/SLC22A1L (organic cation)	602631	AF037064	11p15.5
		Solute carrier family 22, member 4/SLC22A4 (organic cation)	604190	NM_003059	Chr. 5
		Solute carrier family 22, member 5/SLC22A5 (carnitine)	603377	NM_003060	5q33.1
		Solute carrier family 34, member 1/SLC34A1 (sodium phosphate)	182309	NM_003052	5q35
		H <sup>+</sup> -ATPase beta 1 subunit /ATP6B1	267300	AH007312	2cen-q13
		solute carrier family 4, sodium bicarbonate cotransporter, member 4/SLC4A4	603345	NM_003759	4q21
		solute carrier family 4, sodium bicarbonate cotransporter, member 5/SLC4A5	603318	NM_003788	4q21
		carbonic anhydrase II/CA2	259730	NM_000067	8q22
	Acidosis	carbonic anhydrase IV/CA4	114760	NM_000717	17q23
		carbonic anhydrase XII/CA12	603263	AF051882	15q22
		solute carrier family 4, bicarbonate/chloride anion exchanger, member 1/SLC4A1	109270	NM_000342	17q21-q22
		Solute carrier family 9, member A1/SLC9A1 (sodium/hydrogen ion)	107310	M81768	1p36.1-p35

	Solute carrier family 9, member A2/SLC9A2 (sodium/hydrogen ion)	600530	NM_003048	2q11.2
	Solute carrier family 9, member A3/SLC9A3 (sodium/hydrogen ion)	182307	*****	5p15.3
Lithosis	Solute carrier family 13, member 2/SLC13A2 (dicarboxylic acids)	604148	NM_003984	17p11.1-q11.1
Sodium Tolerance	3'(2'), 5'-bisphosphate nucleotidase 1/BPNT	604053	NM_006085	*****
	chloride channel 5/CLCN5	300008	NM_000084	Xp11.22
	chloride channel Ka, kidney/CLCNKA	602024	NM_004070	1p36
	chloride channel Kb, kidney/CLCNKB	602023	NM_000085	1p36
	solute carrier family 12 (sodium/potassium/chloride transporters), member 1/SLC12A1	600839	NM_000338	15q15-q21.1
	solute carrier family 12 (sodium/potassium/chloride transporters), member 2/SLC12A2	600840	NM_001046	5q23.3
	solute carrier family 12 (sodium/chloride transporters), member 2/SLC12A2	600968	NM_000339	16q13
	ATPase, Na+/K+ transporting, alpha 1 polypeptide/ATP1A1	182310	NM_000701	1p13-p11
	ATPase, Na+/K+ transporting, alpha 1 polypeptide-like/ATP1A1L	182360	NM_001676	13q12.1-q12.3
Urine Concentration	ATPase, Na+/K+ transporting, alpha 2 polypeptide/ATP1A2	182340	NM_000702	1q21-q23

	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 1 polypeptide/ATP1B1	182330	NM_001677	1q22-q25
	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 2 polypeptide/ATP1B2	182331	X16645	17p
	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 3 polypeptide/ATP1B3	601867	NM_001679	3q22-q23
	angiotensin vasopressin receptor 2 (nephrogenic diabetes insipidus)	304800	NM_000054	Xq28
	aquaporin 1/AQP1	107776	NM_000385	7p14
	aquaporin 2/AQP2	107777	NM_000486	12q13
	aquaporin 3/AQP3	600170	NM_004925	9p13
	aquaporin 6/AQP6	601383	NM_001652	12q13
Superoxide Dismutase	Superoxide Dismutase 1/SOD1 (soluble)	147450	NM_000454	21q22.1
	Superoxide Dismutase 2/SOD2 (mitochondrial)	147460	X65965	6q25.3
	Superoxide Dismutase 3/SOD3 (extracellular)	185490	NM_003102	4pter-q21
	aldehyde dehydrogenase 1/ALDH1 (liver cytosol)	100640	AH002598	9q21
	aldehyde dehydrogenase 2/ALDH2 (liver mitochondria)	100650	K03001	12q24.2
	aldehyde dehydrogenase 3/ALDH3 (liver cytosol)	100660	M74542	17p11.2

Metabolism of Reactive Oxygen and Nitrogen Species	Protection from Reactive Oxygen and Nitrogen Species	Aldehyde Dehydrogenase	5/acetalddehyde aldehyde dehydrogenase 5, member A1/succinic semialdehyde dehydrogenase/ALDH5A1	100670	NM_00069 _2	9p13
			6/acetalddehyde aldehyde dehydrogenase 6, member A1/succinic semialdehyde dehydrogenase/ALDH6A1	271980	NM_00108 _0	6p22
			7/acetalddehyde aldehyde dehydrogenase 7, member A1/succinic semialdehyde dehydrogenase/ALDH7A1	600463	NM_00069 _3	15q26
			8/acetalddehyde aldehyde dehydrogenase 8, member A1/succinic semialdehyde dehydrogenase/ALDH8A1	600466	NM_00069 _4	11q13
			9/acetalddehyde aldehyde dehydrogenase 9, member A1/succinic semialdehyde dehydrogenase/ALDH9A1	601917	NM_00069 _5	chr. 11
			10/acetalddehyde aldehyde dehydrogenase 10, member A1/succinic semialdehyde dehydrogenase/ALDH10A1	602733	NM_00069 _6	1q22-q23
			11/acetalddehyde aldehyde dehydrogenase 11, member A1/succinic semialdehyde dehydrogenase/ALDH11A1	270200	NM_00038 _2	17p11.2
			12/acetalddehyde aldehyde dehydrogenase 12, member A1/succinic semialdehyde dehydrogenase/ALDH12A1	602841	NM_00115 _9	2q33
			13/acetalddehyde aldehyde dehydrogenase 13, member A1/succinic semialdehyde dehydrogenase/ALDH13A1	230450	NM_00149 _8	6p12
			14/acetalddehyde aldehyde dehydrogenase 14, member A1/succinic semialdehyde dehydrogenase/ALDH14A1	601176	NM_00206 _1	1p22.1
Glutathione		Glutathione	glutathione synthetase/GSS	601002	NM_00017 _8	20q11.2
			glutathione peroxidase/GPX1	138320	M21304	3p21.3
			glutathione peroxidase/GPX2	138319	X68314	14q24.1

4czf01.xls



	glutathione peroxidase GPX3	138321	X58295	5q32-q33.1
	glutathione peroxidase GPX4	138322	X71973	19p13.3
	glutathione peroxidase GPX5	603435	AJ005277	*****
	glutathione reductase	138300	X15722	8p21.1
Metallothioneins	metallothionein 1A/MT1A	156350	NM_005953	16q13
	metallothionein 1B	56349	AH001510	16q13
	metallothionein 1E	156351	M10942	16q13
	metallothionein 1F	156352	M10943	16q13
	metallothionein 1G	156353	J03910	16q13
	metallothionein 2A/MT2A	156360	NM_005953	16q13
	metallothionein 3	139255	NM_005954	16q13
Miscellaneous	glucose-6-phosphate dehydrogenase/G6PD (mitochondrial)	305900	NM_000402	Xq28
	8-oxoguanine DNA glycosylase/CGG1	601982	NM_002542	3p26.2
	Peptide methionine sulfoxide reductase/MSRA	601250	*****	*****
	succinate dehydrogenase complex, subunit C, integral membrane protein/SDHC	602413	NM_003001	1q21
	phospholipase A2 group IB/PLA2G1B	172410	NM_000928	12q23-q24.1
	lipoprotein, Lp(a)/LPA	152200	NM_005557	6q27
	Catalase/CAT	115500	NM_001752	11p13

	thioredoxin-dependent peroxide reductase/TDPX1	600538	NM_00580_9	13q12
IgE Production	interleukin 4 receptor/IL4R	147781	X52425	6p12.1-p11.2
	interferon gamma/IFNG	147570	L07633	12q14
Mast Cell Proliferation	mast cell growth factor/MGF	184745	NM_00399_4	12q22
	interleukin 9 receptor/IL9R	300007	M84747	Xq28
	interleukin 3 receptor/IL3R)	308385	M74782	Xp22.3
Degranulation of Mast Cells	mast cell IgE receptor alpha polypeptide/FCER1A	147140	*****	1q23
	mast cell IgE receptor beta polypeptide/FCER1B	147138	NM_00013_9	11q13
	mast cell IgE receptor beta polypeptide/FCER1G	147139	NM_00410_6	1q23
	SH2-containing inositol 5-phosphatase/SHIP	601582	U57650	2q36-q37
	secretory granule proteoglycan peptide core/PRG1	177040	J03223	10q22.1
Histamine	Histidine Decarboxylase	142704	M60445	15q21-q22
	Histamine receptor H1	600167	AF026261	3p21-p14
	Histamine receptor H2	142703	M64799	*****
	Histamine N-methyltransferase	*****	D16224	chr. 2
	Amine oxidase (copper-containing) 2/AOC2	602268	D88213	17q21
	Amine oxidase (copper-containing) 3/AOC3	603735	AF054985	17q21
	aromatic L-Amino Acid Decarboxylase/AADC	107930	M76180	7p11

Serotonin	tryptophan hydroxylase/TPH	191060	X52836	11p15.3-p14
	14-3-3 protein ETA	113508	X78138	22q12
	14-3-3 protein ZETA	601288	M86400	2p25.2-p25.1
	14-3-3 protein BETA	601289	X57346	20q13.1
	14-3-3 protein SIGMA	601290	X57348	*****
	serotonin 5-HT receptors 5-HT1A, G protein-coupled	109760	X57829	5q11.2-q13
	serotonin 5-HT receptors 5-HT1B, G protein-coupled	182131	M81590	6q13
	serotonin 5-HT receptors 5-HT1C, G protein-coupled	312861	U49516	Xq24
	serotonin 5-HT receptors 5-HT1D, G protein-coupled	182133	M81590	1p36.3-p34.3
	serotonin 5-HT receptors 5-HT1E, G protein-coupled	182132	M91467	6q14-q15
	serotonin 5-HT receptors 5-HT1F, G protein-coupled	182134	L05597	3p12
	serotonin 5-HT receptors 5-HT2A, G protein-coupled	182135	D87030	13q14-q21
	serotonin 5-HT receptors 5-HT2B, G protein-coupled	601122	X77307	2q36.3-q37.1
	serotonin 5-HT receptors 5-HT2C, G protein-coupled	312861	U49516	Xq24
	serotonin transporter	182138	X70697	17q11.1-q12
	monoamine oxidase A/ MAOA	309850	M69226	Xp11.23
	monoamine oxidase B MAOB	309860	M69177	Xp11.23
	serotonin N-Acetyltransferase/SNAT	600950	U40347	17q25
	tryptophan 2,3-dioxygenase/TDO2	191070	NM_005651	4q31-q32

Neutrophil and Eosinophil Chemotaxis	eotaxin precursor/small inducible cytokine, family A, member	601156	U46572	7q21.1-q21.2
	monocyte-derived-neutrophil	146930	M26383	4q12-q13
	chemotactic factor/interleukin 8/IL8	191080	NM_003293	Chr.16
	tryptase alpha/TPS1	191081	NM_003294	Chr.16
Proteases	tryptase beta/TPS2	118938	NM_001836	14q11.2
	chymase 1, mast cell/CMA1	172411	NM_000300	1p35
	phospholipase A2 group IIA/PLA2G2A	172410	NM_000928	12q23-q24.1
	phospholipase A2 group IB/PLA2G1B	603603	*****	16p13.1-p12
Release of Membrane Lipids (common to PAF, leukotriene, and prostaglandin pathways)	phospholipase A2 group X/PLA2G10	600522	U08374	1q25
	phospholipase A2 group IVA/PLA2G4A	603604	AF064594	22q13.1
	phospholipase A2 group IVC/PLA2G4C	603602	*****	chr. 19
	phospholipase A2 group V/PLA2G5	601192	NM_000929	1p36-p34
	phospholipase C beta 3	600230	U26425	11q13
	lysosomal acid lipase	278000	NM_000235	10q24-q25
	CDP-choline:alkylacetylgllycerol cholinephosphotransferase	*****	*****	*****
	platelet activating factor receptor/PTAFR	173393	M88177	1p35-p34.3
	platelet activating factor acetylhydrolase 1/PAFAH1	601690	NM_005084	6p21.2-p12

Platelet Activating Factor (PAF)	platelet activating factor acetylhydrolase, isoform 1B, alpha 1/PAFAH1B1	601545	NM_000430	17p13.3
	platelet activating factor acetylhydrolase, isoform 1B, beta 1/PAFAH1B2	602508	NM_002572	11q23
	platelet activating factor acetylhydrolase, isoform 1B, gamma 1/PAFAH1B3	603074	NM_002573	19q13.1
	platelet activating factor acetylhydrolase 2/PAFAH2	602344	NM_000437	*****
	arachidonate 5-lipoxygenase/ALOX5	152390	NM_000698	Chr.10
Leukotriene	arachidonate 5-lipoxygenase- activating protein/FLAP/ALOX5AP	603700	NM_001629	13q12
	leukotriene A4 hydrolase/LTA4H	151570	NM_000895	12q22
	leukotriene C4 synthase/LTC4S	246530	NM_000897	5q35
	Gamma-glutamyltranspeptidase 1/GGT1	231950	J04131	22q11.1- q11.2
	Gamma-glutamyltranspeptidase 2/GGT2	137181	AH002728	22q11.1
	Gamma-glutamyltransferase-like activity 1/GGTLA1	137168	NM_004121	*****
	renal microsomal dipeptidase/DPEP1	179780	NM_004413	16q24.3
	cysteinyl leukotriene receptor 1/CYSLT1	300201	NM_006639	Xq13-q21
	leukotriene b4 receptor (chemokine receptor-like 1)/LTB4R	601531	NM_000752	14q11.2- q12

Mast Cell and T-Cell Response	prostaglandin endoperoxide synthetase 1/COX1/PTGS1	176805	AH001520	9q32-q33.3
	prostaglandin endoperoxide synthetase 2/COX2/PTGS2	600262	NM_000963	1q25.2-q25.3
	thromboxane A synthase 1/TBXAS1	274180	SEG_D3461	7q34
	prostaglandin D2 synthase	602598	M61900	*****
	prostaglandin I2 synthase/prostacyclin synthase/PTGIS	601699	SEG_D8339	20q13
	prostaglandin E receptor 1, EP1 subtype/PTGER1	176802	NM_000955	19p13.1
	prostaglandin E receptor 2, EP2 subtype/PTGER2	176804	*****	5p13.1
	prostaglandin E receptor 3, EP3 subtype/PTGER3	176806	NM_000957	1p31.2
	prostaglandin E receptor 4, EP4 subtype/PTGER4	601586	NM_000958	5p13.1
	prostaglandin F receptor/PTGFR	600563	L24470	1p31.1
	prostaglandin F2 receptor negative regulator/PTGFRN	601204	U26664	1p13.1-q21.3
	prostaglandin I2 receptor/PTGIR/prostacyclin receptor	600022	SEG_HUM1	19q13.3
	15-hydroxyprostaglandin dehydrogenase/HPGD	601688	NM_000860	4q34-q35
	aldo-keto reductase family 1, member C2/AKR1C2	600450	NM_001353	10p15-p14
	myeloperoxidase/MPO	254600	J02694	17q23.1
	eosinophil peroxidase/EPX	131399	NM_000502	*****

<b>Drug Activation</b>	calreticulin/CALR	109091	CALR	19p13.2
	calnexin/CANX	114217	L18887	5q35
	ceruloplasmin (ferroxidase)/CP	117700	NM_000096	3q21-q24
<b>Antigen Presentation</b>	MHC class II transactivator/MHC2TA	600005	NM_000246	16p13
	MHC class II HLA DR-alpha chain/HLA-DRA	142860	X83114	6p21.3
	MHC class II HLA DR-beta chain/HLA-DRB	142857	M11161	6p21.3
	MHC class II HLA DP-alpha chain/HLA-DPA	142880	M23905	6p21.3
	MHC class II HLA DP-beta chain/HLA-DPB	142858	AH002893	6p21.3
	MHC class II HLA DM-alpha chain/HLA-DMA	142855	NM_006120	6p21.3
	MHC class II HLA DM-beta chain/HLA-DMB	142856	NM_002118	6p21.3
	MHC class II HLA DQ-alpha chain/HLA-DQA	146880	M11124	6p21.3
	MHC class II HLA DQ-beta chain/HLA-DQB	*****	M24364	6p21.3
	MHC class II HLA DN-alpha chain/HLA-DNA	142930	X02882	6p21.3
	MHC class II HLA DO-beta chain/HLA-DOB	600629	NM_002120	6p21.3
	MHC class II antigen gamma chain/CD74	142790	K01144	5q32

T-Cell Receptor	antigen peptide transporter 1/MHC 1/TAP1	170260	NM_000593	6p21.3
	antigen peptide transporter 2/MHC 2/TAP2	170261	NM_000544	6p21.3
	T-cell antigen receptor, alpha subunit/TCRA	186880	Z24457	14q11.2
	T-cell antigen receptor, beta subunit/TCRB	186930	AF011643	7q35
	T-cell antigen receptor, gamma subunit/TCRG	186970	M17325	7p15-p14
	T-cell antigen receptor, delta subunit/TCRD	186810	L36384	14q11.2
	thymocyte antigen receptor complex CD3G, gamma polypeptide (TiT3 complex)/CD3G	186740	NM_000073	11q23
	thymocyte antigen receptor complex CD3D, delta polypeptide (TiT3 complex)/CD3D	186790	NM_000073	11q23
	thymocyte antigen receptor complex CD3E, epsilon polypeptide (TiT3 complex)/CD3E	186830	NM_000073	11q23
	thymocyte antigen receptor complex CD3Z, zeta polypeptide (TiT3 complex)/CD3Z	186780	NM_000073	1q22-q23
	ataxia telangiectasia mutated (includes complementation groups A, C and D)/ATM	208900	NM_000051	11q22.3
	recombination activating gene 1/RAG1	179615	NM_000448	11p13



recombination activating gene		179616	M94633	11p13
T-Cell Receptor Rearrangem ent	interleukin 7 receptor/IL7R	146661	NM_00218 5	5p13
	v-myb avian myeloblastosis viral oncogene homolog/MYB	189990	NM_00537 5	6q22
	core binding factor, alpha 1 subunit/CBFA1	600211	AH005498	6p21
	core-binding factor, beta subunit/PEBP2B/CBFB	121360	L20298	16q22
	ligase I, DNA, ATP-dependent/LIG1	126391	NM_00023 4	19q13.2- q13.3
	ligase IV, DNA, ATP-dependent/LIG4	601837	NM_00231 2	13q22-q34
	X-ray repair, complementing defect in Chinese hamster/Ku antigen, 80 kD/KU80/XRCC5	194364	*****	2q35
	thyroid autoantigen, 70 kD/KU70/G22P1	152690	NM_00146 9	22q11-q13
	T-cell antigen T4/CD4	186940	X87579	12pter-p12
	T-cell antigen CD8, alpha polypeptide (p32)/CD8A	186910	NM_00176 8	2p12
	T-cell antigen CD8, beta polypeptide/CD8B	186730	AH003859	2p12
	T-cell antigen CD28 (Tp44)/CD28	186760	NM_00613 9	2q33-q34
	cytotoxic T-lymphocyte-associated 4/CTLA4	123890	L15006	2q33

CD80 antigen (CD28 antigen ligand 1, B7-1 antigen)/CD80	112203	NM_005191	3q21
CD86 antigen (CD28 antigen ligand 2, B7-2 antigen)/CD86	601020	NM_006889	3q21
T cell receptor-associated protein tyrosine kinase ZAP-70/ZAP70	176947	S69911	2q12
neutrophil common antigen	151460	M23492	1q31-q32
nuclear factor of activated T-cells, cytoplasmic 1/NFATC1	600489	NM_006162	18q23
nuclear factor of activated T-cells, cytoplasmic 2/NFATC2	600490	*****	20q13.2-q13.3
nuclear factor of activated T-cells, cytoplasmic 3/NFATC3	602698	L41066	16q13-q24
nuclear factor of activated T-cells, cytoplasmic 4/NFATC4	602699	L41067	*****
interleukin 2 receptor alpha/IL2RA	147730	X01057	10p15-p14
interleukin 2 receptor beta/IL2RB	146710	M26062	22q11.2-q13
interleukin 2 receptor gamma/IL2RG	308380	D11086	Xq13
interleukin 6 receptor/IL6R	147880	X12830	1q21
interleukin 9 receptor/IL9R	300007	M84747	Xq28
interleukin receptor 13 alpha/IL13RA1	300119	S80963	Chr.X
interleukin receptor 13 alpha2/IL13RA2	300130	X95302	Xq24
interleukin 15 receptor alpha/IL15RA	601070	U31628	10p15-p14
transforming growth factor/TGFB1	190180	M60315	19q13.1-q13
transforming growth factor/TGFB2	190220	M19154	1q41
transforming growth factor/TGFB3	190230	X14149	14q24
tumor necrosis factor beta/TNFB/lymp	153440	NM_000595	6p21.3

**Immune Response**  
(additional genes in Immunology)

**T-Cell Expansion**

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	tumor necrosis factor ligand superfamily, member 6/TNFSF6	134638	NM_000639	1q23
	tumor necrosis factor receptor superfamily, member 6/TNFRSF6	134637	NM_000043	10q24.1
	caspase 10, apoptosis-related cysteine protease/CASP10	601762	NM_001230	2q33-q34
	B-cell antigen CD20/B-lymphocyte differentiation antigen B1/CD20	112210	AH003353	11q13
	B-cell antigen CD72/CD72	107272	NM_001782	9p
	natural resistance-associated macrophage protein 1/NRAMP1/solute carrier family 11, member 1/SLC11A2	600266	AH002806	2q35
	natural resistance-associated macrophage protein 2/NRAMP2/solute carrier family 11, member 2/SLC11A2	600523	AB015355	12q13
	T-lymphocyte antigen CDW52 (CAMPATH-1 antigen)/CDW52	114280	NM_001803	*****
	B-cell antigen CD22/CD22	107266	NM_001771	19q13.1
	B-cell antigen CD24/CD24	600074	X69397	6q21
	leukocyte antigen CD156/disintegrin and metalloprotease domain 8/ADAM8/CD156	602267	NM_001109	10q26.3
	platelet antigen CD151/platelet-endothelial cell tetraspan antigen 3/PETA3/CD151	602243	NM_004357	11p15.5

## Receptors

	IIA for Fc fragment of IgG/FCGR2A/CD32	146790	NM_004001	1q21-q23
	activated leucocyte cell adhesion molecule/CD6 ligand/ALCAM	601662	NM_001627	3q13.1-q13.2
	lymphocyte antigen CD79A/immunoglobulin-associated alpha/CD79A	112205	NM_001783	19q13.2
	lymphocyte antigen CD79B/immunoglobulin-associated beta/CD79B	147245	L27587	17q23
Signalling	regulator of G-protein signalling 1/RGS1	600323	NM_002922	1q31
Immunoglobulin Light Chains	immunoglobulin K light chain constant region locus/IGKC	147200	*****	2p12
	immunoglobulin K light chain variable region locus/IGKV	146980	K01322	2p12
	immunoglobulin K light chain joining region locus/IGKJ	146970	*****	2p12
	immunoglobulin L light chain constant region locus/IGLC1	147220	NM_006146	22q11.2
	immunoglobulin L light chain joining region locus/IGLJ	147230	NM_006146	22q11.2
	immunoglobulin L light chain variable region locus/IGLJ	147240	NM_006146	22q11.2
	immunoglobulin A heavy chain constant region locus 1/IGHA1	146900	*****	14q32.33
	immunoglobulin A heavy chain constant region locus 2/IGHA2	147000	*****	14q32.33

Immunoglobulin Heavy Chains	immunoglobulin D heavy chain constant region locus/IGHD	147170	*****	14q32.33
	immunoglobulin E heavy chain constant region locus/IGHE	147180	*****	14q32.33
	immunoglobulin G heavy chain constant region locus 1/IGHG1	147100	*****	14q32.33
	immunoglobulin G heavy chain constant region locus 2/IGHG2	147110	*****	14q32.33
	immunoglobulin G heavy chain constant region locus 3/IGHG3	147120	*****	14q32.33
	immunoglobulin G heavy chain constant region locus 4/IGHG4	147130	*****	14q32.33
	immunoglobulin M heavy chain constant region locus/IGHM	147020	*****	14q32.33
	immunoglobulin heavy chain variable region locus 1/IGHV1	147070	X92279	14q32.33
	immunoglobulin heavy chain variable region locus 2/IGHV2	600949	*****	16p11
	immunoglobulin heavy chain diversity region locus 1/IGHDY1	146910	X97051	14q32.33
	immunoglobulin heavy chain diversity region locus 2/IGHDY2	146990	L25544	15q11-q12
	immunoglobulin heavy chain joining region locus/IGHJ	147010	*****	14q32.33
	recombination activating gene 1/RAG1	179615	NM_000448	11p13
	recombination activating gene 2/RAG2	179616	M94633	11p13

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B-Cell Response	Immunoglobulin Gene Rearrangement	immunoglobulin kappa J region recombination signal binding protein/RBPJK/IGKJRB1	147183	L07872	9p13-p12
		Bruton agammaglobulinemia tyrosine kinase/BTK	300300	NM_00006 1	Xq21.3-q22
		interleukin 7 receptor/IL7R	146661	NM_00218 5	5p13
		interferon-gamma receptor 1/IFNGR1	107470	NM_00041 6	6q23-q24
		interferon-gamma receptor 2/IFNGR2	147569	NM_00553 4	21q22.1- q22.2
		interleukin 4 receptor precursor/IL4R	147781	NM_00041 8	16p12.1- p11.2
		interleukin 4 receptor precursor/IL4R	147781	NM_00041 8	16p12.1- p11.2
		ligase I, DNA, ATP-dependent/LIG1	126391	NM_00023 4	19q13.2- q13.3
		ligase IV, DNA, ATP-dependent/LIG4	601837	NM_00231 2	13q22-q34
		X-ray repair, complementing defect in Chinese hamster/Ku antigen, 80 kD/KU80/XRCC5	194364	*****	2q35
		thyroid autoantigen, 70 kD/KU70/G22P1	152690	NM_00146 9	22q11-q13
		nuclear factor kappa-B DNA binding subunit 1/NFKB1	164011	M58603	4q23-q24
		nuclear factor kappa-B DNA binding subunit 2/NFKB2	164012	NM_00250 2	10q24

Immunoglobulin Gene Transcription	nuclear factor kappa-B subunit 3/NFKB3	164014	Z22949	11q12-q13
	nuclear factor of kappa light chain gene enhancer in B cells, inhibitor alpha/NFKBIA	164008	*****	14q13
	nuclear factor of kappa light chain gene enhancer in B cells, inhibitor beta/NFKBIB	603258	NM_002503	8p11.2
	YY1 transcription factor/YY1	600013	NM_003403	14q
	immunoglobulin transcription factor 1/TF1/transcription factor 3/TCF3	147141	*****	19p13.3
	immunoglobulin transcription factor 2/TF2/transcription factor 4/TCF4	602272	NM_003199	18q21.1
	immunoglobulin mu binding protein 2/IGHMBP2	600502	NM_002180	11q13.2-q13.4
	transcription factor binding to IGHM enhancer 3/TFE3	314310	NM_006521	Xp11.22
	homeobox protein OCT1/POU domain transcription factor 2, class 1/POU2F1	164175	NM_002697	1q22-q23
	homeobox protein OCT2/POU domain transcription factor 2, class 2/POU2F2	164176	M22596	Chr.19
	POU domain, class 2, associating factor 1/POU2AF1	601206	NM_006235	11q23.1
	inhibitor of DNA binding 1, dominant negative helix-loop-helix protein/ID1	600349	NM_002165	20q11.1
	inhibitor of DNA binding 2, dominant negative helix-loop-helix protein/ID2	600386	NM_002166	2p25

Immunoglobulin Isotype Switching	B-cell antigen CD40/tumor necrosis factor receptor superfamily, member 5/CD40/TNFRSF5	109535	NM_001250	20q12-q13.2
	paired box gene 5/B-cell lineage-specific activator protein/BSAP/PAX5	167414	*****	9p13
	lymphocyte function-associated antigen, type 3/LFA3/LEU7/CD58	153420	NM_001779	1p13
	interleukin 10 receptor, alpha/IL10RA	146933	NM_001558	11q23.3
	lymphocyte antigen CD45/protein tyrosine phosphatase, receptor type, c polypeptide/PTPRC/CD45	151460	NM_002838	1q31-q32
	prostaglandin E receptor 1, EP1 subtype/PTGER1	176802	NM_000955	19p13.1
	prostaglandin E receptor 2, EP2 subtype/PTGER2	176804	*****	5p13.1
	prostaglandin E receptor 3, EP3 subtype/PTGER3	176806	NM_000957	1p31.2
	prostaglandin E receptor 4, EP4 subtype/PTGER4	601586	NM_000958	5p13.1
	interleukin 13 receptor, alpha 1/IL13RA1	300119	NM_001560	Chr.X
	interleukin receptor 13 alpha2/IL13A2	300130	X95302	Xq24
	interferon-gamma receptor 1/IFNGR1	107470	NM_000416	6q23-q24
	interferon-gamma receptor 2/IFNGR2	147569	NM_005534	21q22.1-q22.2
	interleukin 5 receptor alpha/IL5RA	147851	M96652	3p26-p24:



transforming growth factor, beta receptor I (activin A receptor type II- like kinase, 53kD)/TGFR1	190181	NM_00461 2	9q33-q34
transforming growth factor, beta receptor II (70-80kD)/TGFR2	190182	NM_00324 2	3p22
transforming growth factor, beta receptor III (betaglycan, 90kD)/TGFR3	600742	NM_00324 3	1p33-p32
X-ray repair, complementing defect in Chinese hamster/Ku antigen, 80 kD/KU80/XRCC5	194364	*****	2q35
thyroid autoantigen, 70 kD/KU70/G22P1	152690	NM_00146 9	22q11-q13
granulocyte-macrophage colony stimulating factor 2/CSF2	138960	NM_00075 8	5q31.1
macrophage-specific colony- stimulating factor/CSF1	120420	AH005300	1p21-p13
granulocyte colony stimulating factor 3/CSF3	138970	NM_00075 9	17q11.2- q12
colony stimulating factor 1 receptor/CSFR1	164770	U63963	5q33.2- q33.3
granulocyte-macrophage colony stimulating factor 2 receptor, alpha, low-affinity/CSF2RA	306250	NM_00614 0	Xp22.32
granulocyte-macrophage colony stimulating factor 2 receptor, beta/CSF2RB	138981	U18373	22q12.2- q13.1
granulocyte-macrophage colony stimulating factor 2 receptor, alpha, Y chromosomal/CSF2RY	425000	*****	Yp11

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Myeloid Differentiation	Granulocyte, Macrophage, Erythrocyte, and Platelet Differentiation	flt3 ligand/FMS-related tyrosine kinase 3 ligand/FLT3LG	600007	U03858	19q13.3
		STAT induced STAT inhibitor 3/SSI- 3	604176	NM_00395 5	*****
		erythropoietin/EPO	133170	NM_00079 9	7q21
		erythropoietin receptor/EPOR	133171	NM_00012 1	19p13.3- p13.2
		Janus kinase 2 (a protein tyrosine kinase)/JAK2	147796	NM_00497 2	9p24
		STAM-like protein containing SH3 and ITAM domains 2/STAM2	*****	NM_00584 3	*****
		ribosomal protein S7/RPS7	603474	NM_00101 1	19q13.2
		signal transducer and activator of transcription 5A/STAT5A	601511	NM_00315 2	17q11.2
		BCL-X/BCLX	600039	Z23115	*****
		thrombopoietin (MLV oncogene ligand, megakaryocyte growth and development factor)/THPO	600044	NM_00046 0	3q26.3-q27
		myeloproliferative leukemia virus oncogene/MPL/thrombopoietin receptor/TPOR	159530	NM_00537 3	1p34
		FMS-related tyrosine kinase 3/FLT3	136351	NM_00411 9	13q12

Table 4. Inflammation Gene List

Class	Pathway	Function	Name	OMIM	GID	Locus
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Major Histocompatibility Complex I	MHC class I HLA A/HLA-A	142800	AF148863	6p21.3
	MHC class I HLA B/HLA-B	142830	NM_005514	6p21.3
	MHC class I HLA C/HLA-C	142840	AF168611	6p21.3
	MHC class I HLA E/HLA-E	143010	NM_005516	6p21.3
	MHC class I HLA F/HLA-F	143110	X17093	6p21.3
	MHC class I HLA G/HLA-G	142871	AH005893	6p21.3
	beta-2-microglobulin/B2M	109700	NM_004048	15q21-q22
Major Histocompatibility Complex I- Related	thymocyte antigen CD1A/CD1A	188370	AF142665	1q21-q23
	thymocyte antigen CD1B/CD1B	188360	AF142666	1q21-q23
	thymocyte antigen CD1C/CD1C	188340	AF142667	1q21-q23
	thymocyte antigen CD1D/CD1D	188410	AF142668	1q21-q23
	thymocyte antigen CD1E/CD1E	188411	AF142669	1q21-q23
	interferon-gamma receptor 1/IFNGR1	107470	NM_000416	6q23-q24
MHC Class I Transcription	interferon-gamma receptor 2/IFNGR2	147569	NM_005534	21q22.1-q22.2
	TATA box binding protein (TBP)-associated factor, RNA polymerase II, A, 250kD/TAF2A	313650	NM_004606	Xq13
	interferon-regulatory factor 1/IRF1	147575	NM_002198	5q31.1
	nuclear factor kappa-B DNA binding subunit 2/NFKB2	164012	NM_002502	10q24
	MHC class II HLA DR-alpha chain/HLA-DRA	142860	X83114	6p21.3

Major Histocompat- ibility Complex II	MHC class II HLA DR-beta chain/HLA-DRB	142857	M11161	6p21.3
	MHC class II HLA DP-alpha chain/HLA-DPA	142880	M23905	6p21.3
	MHC class II HLA DP-beta chain/HLA-DPB	142858	AH002893	6p21.3
	MHC class II HLA DM-alpha chain/HLA-DMA	142855	NM_006120	6p21.3
	MHC class II HLA DM-beta chain/HLA-DMB	142856	NM_002118	6p21.3
	MHC class II HLA DQ-alpha chain/HLA-DQA	146880	M11124	6p21.3
	MHC class II HLA DQ-beta chain/HLA-DQB	*****	M24364	6p21.3
	MHC class II HLA DN-alpha chain/HLA-DNA	142930	X02882	6p21.3
	MHC class II HLA DO-beta chain/HLA-DOB	600629	NM_002120	6p21.3
	MHC class II antigen gamma chain/CD74	142790	K01144	5q32
	antigen peptide transporter 1/MHC 1/TAP1	170260	NM_000593	6p21.3
	antigen peptide transporter 2/MHC 2/TAP2	170261	NM_000544	6p21.3
	interferon-gamma receptor 1/IFNGR1	107470	NM_000416	6q23-q24
	interferon-gamma receptor 2/IFNGR2	147569	NM_005534	21q22.1- q22.2
	regulatory factor X, 5 (influences HLA class II expression)/RFX5	601863	NM_000449	1q21.1- q21.3

Immune Discrimination (Self vs Non-Self)	Antigen Presentation and Recognition	MHC Class II Transcription	MHC class II transactivator/MHC2TA	600005	NM_000246	16p13
			regulatory factor X-associated protein/RFXAP	601861	NM_000538	13q14
			regulatory factor X-associated ankyrin-containing protein/RFXANK	603200	NM_003721	19p12
			regulatory factor X, 2 (influences HLA class II expression)/RFX2	142765	*****	19p13.3-p13.2
			nuclear transcription factor, X-box binding 1/NFX1	603255	NM_002504	*****
			nuclear transcription factor Y, alpha/NFYA	189903	NM_002505	6p21.3
			nuclear transcription factor Y, beta/NFYB	189904	NM_006166	12q22-q23
			T-cell antigen receptor, alpha subunit/TCRA	186880	Z24457	14q11.2
			T-cell antigen receptor, beta subunit/TCRB	186930	AF011643	7q35
			T-cell antigen receptor, gamma subunit/TCRG	186970	M17325	7p15-p14
			T-cell antigen receptor, delta subunit/TCRD	186810	L36384	14q11.2
			thymocyte antigen receptor complex CD3G, gamma polypeptide (TiT3 complex)/CD3G	186740	NM_000073	11q23
			thymocyte antigen receptor complex CD3D, delta polypeptide (TiT3 complex)/CD3D	186790	NM_000732	11q23
		T-Cell Antigen Receptor Complex				

Rearrangement of T-Cell Antigen Receptor Complex	thymocyte antigen receptor complex CD3E, epsilon polypeptide (TiT3 complex)/CD3E	186830	NM_000733	11q23
	thymocyte antigen receptor complex CD3Z, zeta polypeptide (TiT3 complex)/CD3Z	186780	NM_000734	1q22-q23
	(p50), sheep red blood cell receptor/CD2	186990	NM_001767	1p13.1
	ataxia telangiectasia mutated (includes complementation groups A, C and D)/ATM	208900	NM_000051	11q22.3
	recombination activating gene 1/RAG1	179615	NM_000448	11p13
	recombination activating gene 2/RAG2	179616	M94633	11p13
	interleukin 7 receptor/IL7R	146661	NM_002185	5p13
	v-myb avian myeloblastosis viral oncogene homolog/MYB	189990	NM_005375	6q22
	core binding factor, alpha 1 subunit/CBFA1	600211	AH005498	6p21
	core-binding factor, beta subunit/PEBP2B/CBFB	121360	L20298	16q22
	ligase I, DNA, ATP-dependent/LIG1	126391	NM_000234	19q13.2-q13.3
	ligase IV, DNA, ATP-dependent/LIG4	601837	NM_002312	13q22-q34
	X-ray repair, complementing defect in Chinese hamster/Ku antigen, 80 kD/KU80/XRCC5	194364	*****	2q35

	thyroid autoantigen, 70 kD/KU70/G22P1	152690	NM_00146 9	22q11-q13
Transcription of T-Cell Antigen Receptor Complex	GATA-binding protein 3/GATA3	131320	NM_00205 1	10p15
	long form transcription factor C-MAF/CMAF	*****	AF055377	*****
	B-cell antigen CD25/interleukin 2 receptor, alpha chain/IL2RA/CD25	147730	10p15-p14	10p15-p14
	interleukin 2 receptor, beta/IL2RB	146710	NM_00087 8	22q11.2-q13
	interleukin 2 receptor, gamma chain/IL2RG	308380	NM_00020 6	Xq13
	transcription factor 1/hepatic nuclear factor /HNF1/albumin proximal factor/TCF1	142410	NM_00054 5	12q24.2
	lymphocyte antigen CD79A/immunoglobulin-associated alpha/CD79A	112205	NM_00178 3	19q13.2
B-Cell Antigen Receptor Complex	lymphocyte antigen CD79B/immunoglobulin-associated beta/CD79B	147245	L27587	17q23
	interferon regulatory factor 1/IRF1	147575	NM_00219 8	5q31.1
	interferon regulatory factor 2/IRF2	147576	NM_00219 9	4q35.1
	interferon consensus sequence binding protein 1/ICSBP1	601565	NM_00216 3	*****
	interferon alpha 1/IFNA1	147660	X02956	9p22
	interferon alpha 2/IFNA2	147562	Y11834	9p22

Interferons	Synthesis		interferon alpha 4/IFNA4	147564	*****	9p22
			interferon alpha 5/IFNA5	147565	NM_00216 <sub>9</sub>	9p22
			interferon alpha 6/IFNA6	147566	*****	9p22
			interferon alpha 7/IFNA7	147567	*****	9p22
			interferon alpha 8/IFNA8	147568	NM_00217 <sub>0</sub>	9p22
			interferon alpha 10/IFNA10	147577	NM_00217 <sub>1</sub>	9p22
			interferon alpha 13/IFNA13	147578	NM_00690 <sub>0</sub>	9p22
			interferon alpha 14/IFNA14	147579	NM_00217 <sub>2</sub>	9p22
			interferon alpha 16/IFNA16	147580	NM_00217 <sub>3</sub>	9p22
			interferon alpha 17/IFNA17	147583	*****	9p22
			interferon alpha 21/IFNA21	147584	NM_00217 <sub>5</sub>	9p22
			interferon beta 1/IFNB1	147640	NM_00217 <sub>6</sub>	9p21
			interferon beta 3/IFNB3	147860	K03196	Chr.8
			interferon gamma/IFNG	147570	L07633	12q14
			interferon omega 1/IFNW1	147553	NM_00217 <sub>7</sub>	9p21
	Receptors		interferon (alpha, beta and omega) receptor 1/IFNAR1	107450	X77722	21q22.1
			interferon (alpha, beta and omega) receptor 2/IFNAR2	602376	NM_00087 <sub>4</sub>	21q22.1
			interferon-gamma receptor 1/IFNGR1	107470	NM_00041 <sub>6</sub>	6q23-q24



interferon-gamma receptor 2/IFNGR2	147569	NM_005534	21q22.1-q22.2
interleukin enhancer binding factor 1/ILF1	147685	NM_004514	17q25
interleukin enhancer binding factor 2, 45 kD/ILF2	603181	NM_004515	*****
interleukin enhancer binding factor 3, 90 kD/ILF3	603182	NM_004516	*****
interleukin 1 alpha/IL1A2	147761	M15330	3q14
interleukin 1 beta/IL1B	147720	AF043335	2q14
apoptosis-related cysteine protease 1/interleukin 1-beta converting enzyme/ICE/caspase 1/CASP1	147678	NM_001223	11q22.2-q22.3
interleukin 2/IL2	147680	X01586	4q26-q27
interleukin 3/IL3	147740	NM_000588	5q31.1
interleukin 4/IL4	147780	NM_000589	5q31.1
interleukin 5/IL5	147850	NM_000879	5q31.1
interleukin 6/IL6	147620	AF048692	7p21
interleukin 7/IL7	146660	NM_000880	8q12-q13
interleukin 8/IL8	146930	M26383	4q12-q13
interleukin 9/IL9	146931	X17543	5q31.1
interleukin 10/IL10	124092	M57627	1q31-q32
interleukin 11 beta/IL11B	147681	NM_000881	19q13.3-q13.4

Synthesis

Interleukins	interleukin 12A (natural killer cell stimulatory factor 1, cytotoxic lymphocyte maturation factor 1, p35)/IL12A	161560	NM_002187	3p12-q13.2
	interleukin 12B/IL12B	161561	NM_000440	5q31.1-q33.1
	interleukin 13/IL13	147683	NM_002188	5q31
	interleukin 15/IL15	600554	U14407	4q31
	interleukin 16/IL16	603035	NM_004513	*****
	interleukin 17 (cytotoxic T-lymphocyte-associated serine esterase 3)/IL17	603149	NM_002190	2q31
	interleukin 18 (interferon-gamma-inducing factor)/IL18	600953	NM_001562	11q22.2-q22.3
	interleukin 1 receptor, type 1/IL1R1	147810	NM_000877	2q12
	interleukin 1 receptor, type 2/IL1R2	147811	NM_004633	2q12-q22
	interleukin 1 receptor-like 2/IL1RL2	*****	NM_003854	*****
	interleukin 1 receptor accessory protein/IL1RAP	602626	NM_002182	3q28
	B-cell antigen CD25/interleukin 2 receptor, alpha chain/IL2RA/CD25	147730	10p15-p14	10p15-p14
	interleukin 2 receptor, beta/IL2RB	146710	NM_000878	22q11.2-q13
	interleukin 2 receptor, gamma chain/IL2RG	308380	NM_000206	Xq13
	interleukin 3 alpha receptor/IL3RA	308385	M74782	Xp22.3

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Receptors	interleukin 4 receptor precursor/IL4R	147781	NM_000418	16p12.1-p11.2
	interleukin 5 receptor alpha/IL5RA	147851	M96652	3p26-p24;
	interleukin 6 receptor/IL6R	147880	NM_000565	1q21
	interleukin 7 receptor/IL7R	146661	NM_002185	5p13
	interleukin 9 receptor/IL9R	300007	NM_002186	Xq28
	interleukin 10 receptor, alpha/IL10RA	146933	NM_001558	11q23.3
	interleukin 10 receptor beta/IL10RB	*****	NM_000628	*****
	interleukin receptor 11 alpha/IL11RA	600939	NM_004512	9p13
	interleukin 12 receptor, beta 1/IL12RB1	600939	NM_005535	9p13
	interleukin 12 receptor, beta 2/IL12RB2	601642	NM_001559	1p31.2
	interleukin 13 receptor, alpha 1/IL13RA1	300119	NM_001560	Chr.X
	interleukin receptor 13 alpha2/IL13A2	300130	X95302	Xq24
	interleukin 15 receptor, alpha/IL15RA	601070	NM_002189	10p15-p14
	interleukin 18 receptor 1/IL18R1	*****	NM_003855	*****
	interleukin 18 receptor accessory protein/IL18RAP	*****	NM_003853	*****
	LPS-Induced TNF-Alpha Factor/LITAF	603795	U77396	16p13.3-p12

tumor necrosis factor alpha/TNFA	191160	X01394	6p21.3
tumor necrosis factor beta/TNFB/lymphotoxin alpha/LTA	153440	NM_00059 5	6p21.3
tumor necrosis factor C/TNFC/lymphotoxin-beta/LTB	600978	NM_00234 1	6p21.3
tumor necrosis factor ligand superfamily, member 4/TNFSF4	603594	NM_00332 6	1q25
tumor necrosis factor ligand superfamily, member 5/TNFSF5	308230	NM_00007 4	Xq26
tumor necrosis factor ligand superfamily, member 6/TNFSF6	134638	NM_00063 9	1q23
B-cell antigen CD70/tumor necrosis factor ligand superfamily, member 7/TNFSF7/CD27 ligand/CD70	602840	NM_00125 2	19p13
tumor necrosis factor ligand superfamily, member 8/TNFSF8	603875	NM_00124 4	9q33
tumor necrosis factor ligand superfamily, member 10/TNFSF10	603598	NM_00381 0	3q26
tumor necrosis factor ligand superfamily, member 11/TNFSF11	602642	NM_00370 1	13q14
tumor necrosis factor ligand superfamily, member 12/TNFSF12	602695	NM_00380 9	17p13.3
tumor necrosis factor ligand superfamily, member 13B/TNFSF13B	603969	NM_00657 3	13q32-q34
tumor necrosis factor ligand superfamily, member 15/TNFSF15	604052	*****	9q33
tumor necrosis factor receptor superfamily, member 1A/TNFRSF1A	191190	NM_00106 5	12p13.2
tumor necrosis factor receptor superfamily, member 1B/TNFRSF1B	191191	NM_00106 6	1p36.3- p36.2

Synthesis

lymphotoxin beta receptor (TNFR superfamily, member 3/LTBR	600979	NM_00234 2	12p13
tumor necrosis factor receptor superfamily, member 4/TNFRSF4	600315	NM_00332 7	1p36
B-cell antigen CD40/tumor necrosis factor receptor superfamily, member 5/CD40/TNFRSF5	109535	NM_00125 0	20q12- q13.2
lymphocyte antigen CD95/tumor necrosis factor receptor superfamily, member 6/TNFRSF6/CD95	134637	NM_00004 3	10q24.1
tumor necrosis factor receptor superfamily, member 6B/TNFRSF6B	603361	NM_00382 3	20q13
T-cell antigen CD27/tumor necrosis factor receptor superfamily, member 7/CD27/TNFRSF7	186711	M63928	12p13
lymphocyte antigen CD30/tumor necrosis factor receptor superfamily, member 8/CD30/TNFRSF8	153243	NM_00124 3	1p36
tumor necrosis factor receptor superfamily, member 9/TNFRSF9	602250	NM_00156 1	1p36
tumor necrosis factor receptor superfamily, member	603611	NM_00384 4	8p21
tumor necrosis factor receptor superfamily, member	603612	NM_00384 2	8p22-p21
tumor necrosis factor receptor superfamily, member	603613	AF014794	8p22-p21
tumor necrosis factor receptor superfamily, member	603614	NM_00384 0	8p21
tumor necrosis factor receptor superfamily, member	603499	NM_00383 9	18q22.1

## Receptors

Tumor  
Necrosis  
Factor  
Ligand  
Superfamily

Transforming Growth Factor	Synthesis	tumor necrosis factor receptor superfamily, member 11/TNFRSF11	602643	NM_002546	8q24
		tumor necrosis factor receptor superfamily, member 12/TNFRSF12	603366	NM_003790	1p36.3
		tumor necrosis factor receptor superfamily, member 14/TNFRSF14	602746	NM_003820	1p36.3-p36.2
		tumor necrosis factor receptor superfamily, member 16/TNFRSF16	162010	NM_002507	17q21-q22
		tumor necrosis factor receptor superfamily, member 17/TNFRSF17	109545	Z14954	16p13.1
		tumor necrosis factor receptor superfamily, member 18/TNFRSF18	603905	*****	1p36.3
		transforming growth factor, transforming growth factor, beta-1/TGFB1	190170	NM_003236	2p13
		transforming growth factor, beta-2/TGFB2	190180	M60315	9q13.1-q13.3
		transforming growth factor, beta-3/TGFB3	190220	NM_003238	1q41
	Receptors	growth differentiation factor 1/GDF1	190230	NM_003239	14q24
		transforming growth factor, beta receptor I (activin A receptor type II-like kinase, 53kD)/TGFBRI	602880	NM_001492	19p12
		transforming growth factor, beta receptor II (70-80kD)/TGFBRII	190181	NM_004612	9q33-q34
		transforming growth factor, beta receptor III (betaglycan, 200kD)/TGFBRIII	190182	NM_003242	3p22
		transforming growth factor, beta receptor III (betaglycan, 200kD)/TGFBRIII	600742	NM_003243	1p33-p32

small inducible cytokine subfamily A (Cys-Cys), member 1/ inflammatory cytokine I309/SCYA1	182281	NM_00298 1	Chr.17
small inducible cytokine subfamily A (Cys-Cys), member 2/monocyte chemotactic protein 1/MCP1/SCYA2	158105	NM_00298 2	17q11.2- q12
small inducible cytokine subfamily A (Cys-Cys), member 3/macrophage inflammatory protein 1A/MIPIA/SCYA3	182283	NM_00298 3	17q11-q21
small inducible cytokine subfamily A (Cys-Cys), member 3-like 1/LD78- beta/SCYA3L1	601395	D90144	17q11.2
small inducible cytokine subfamily A (Cys-Cys), member 4/macrophage inflammatory protein 1B/MIP1B/SCYA4	182284	NM_00298 4	17q21-q23
small inducible cytokine subfamily A (Cys-Cys), member 4-like/macrophage inflammatory protein 1B/MIP1B/SCYA4L	603782	X52149	17q11.2
small inducible cytokine subfamily A (Cys-Cys), member 5/T-cell specific protein p228/TCP228/SCYA5	187011	NM_00298 5	17q11.2- q12
small inducible cytokine subfamily A (Cys-Cys), member 6/SCYA6	*****	*****	*****
small inducible cytokine subfamily A (Cys-Cys), member 7/monocyte chemotactic protein 3/MCP3/SCYA7	158106	AF043338	17q11.2- q12

small inducible cytokine subfamily A (Cys-Cys), member 8/monocyte chemotactic protein 2/MCP2/SCYA8	602283	NM_00562 3	17q11.2
small inducible cytokine subfamily A (Cys-Cys), member 9/10/SCYA9SCY10	*****	*****	*****
small inducible cytokine subfamily A (Cys-Cys), member 11/eotaxin/SCYA11	601156	NM_00298 6	17q21.1- q21.2
small inducible cytokine subfamily A (Cys-Cys), member 12/SCYA12	*****	*****	*****
small inducible cytokine subfamily A (Cys-Cys), member 13/monocyte chemotactic protein 4/MCP4/SCYA13	601391	NM_00540 8	17q11.2
small inducible cytokine subfamily A (Cys-Cys), member 14/new cc chemokine 2/NCC2/SCYA14	601392	NM_00459 0	17q11.2
small inducible cytokine subfamily A (Cys-Cys), member 15/leukotactin 1/LKN1/SCYA15	601393	NM_00416 7	17q11.2
small inducible cytokine subfamily A (Cys-Cys), member 16/new cc chemokine 4/NCC4/SCYA16	601394	NM_00459 0	17q11.2
small inducible cytokine subfamily A (Cys-Cys), member 17/thymus and activation-regulated chemokine/TARC/SCYA17	601520	NM_00298 7	16q13



small inducible cytokine subfamily A (Cys-Cys), member 18/pulmonary and activation-regulated chemokine/PARC/SCYA18	603757	NM_00298 8	17q11.2
small inducible cytokine subfamily A (Cys-Cys), member 19/macrophage inflammatory protein 3B/MIP3B/SCYA19	602227	NM_00627 4	9p13
small inducible cytokine subfamily A (Cys-Cys), member 20/macrophage inflammatory protein 3A/MIP3A/exodus 1/SCYA20	601960	NM_00459 1	2q33-q37
small inducible cytokine subfamily A (Cys-Cys), member 21/secondary lymphoid tissue chemokine/SLC/exodus 2/SCYA21	602737	NM_00298 9	9p13
small inducible cytokine subfamily A (Cys-Cys), member 22/SCYA22	602957	NM_00299 0	16q13
small inducible cytokine subfamily A (Cys-Cys), member 23/myeloid progenitor inhibitory factor 1/MPIF1/SCYA23	602494	NM_00506 4	*****
small inducible cytokine subfamily A (Cys-Cys), member 24/myeloid progenitor inhibitory factor 2/MPIF2/SCYA24	602495	NM_00299 1	7q11.23
small inducible cytokine subfamily A (Cys-Cys), member 25/thymus- expressed chemokine/TECK/SCYA25	602565	NM_00562 4	19p13.2

**Synthesis**  
(see also  
signaling and  
transcription  
factors  
below)

**Cytokine-  
Mediated  
Immune  
Regulation**

## Chemokines

small inducible cytokine subfamily A (Cys-Cys), member 26/eotaxin 3/SCYA26	*****	AA716120	Chr. 7
small inducible cytokine subfamily A (Cys-Cys), member 27/ALP/SCYA27	*****	*****	Chr. 9
small inducible cytokine subfamily B (Cys-X-Cys), member 1/SCXB26	155730	NM_001511	4q12-q13
small inducible cytokine subfamily B (Cys-X-Cys), member 2/SCXB27	139110	NM_002089	4q12-q13
small inducible cytokine subfamily B (Cys-X-Cys), member 3/SCXB28	139111	AA935273	4q12-q13
small inducible cytokine subfamily B (Cys-X-Cys), member 4/SCXB4/platelet factor 4/PF4	173460	NM_002619	4q12-q13
small inducible cytokine subfamily B (Cys-X-Cys), member 5/epithelial- derived neutrophil-activating peptide 78/SCYB5	600324	NM_002994	4q13-q21
small inducible cytokine subfamily B (Cys-X-Cys), member 6/granulocyte chemotactic protein 2/GCP2/SCYB6	138965	U83303	4q12-q21
small inducible cytokine subfamily B (Cys-X-Cys), member 7/SCYB7	121010	NM_002704	4p12-q13
small inducible cytokine subfamily B (Cys-X-Cys), member 8/SCYB8/ interleukin 8/IL8	146930	M26383	4q12-q13
small inducible cytokine subfamily B (Cys-X-Cys), member 9/SCYB9	601704	AA037522	4q21

small inducible cytokine subfamily B (Cys-X-Cys), member 10/SCYB10interferon (gamma)- induced protein of 10 kDa/INP10	147310	NM_00156 5	4q21
small inducible cytokine subfamily B (Cys-X-Cys), member 11/SCYB11	*****	AA361853	Chr. 4
small inducible cytokine subfamily B (Cys-X-Cys), member 12/SCYB12/stromal cell-driven factor/SDF1	600835	L36033	10q11.1
small inducible cytokine subfamily B (Cys-X-Cys), member 13/SCYB13	*****	*****	*****
small inducible cytokine subfamily B (Cys-X-Cys), member 14/SCYB14	604186	AC005738	5q31
small inducible cytokine subfamily C, member 1/lymphotactin/LTN/SCYC1	600250	NM_00299 5	1q21-q25
small inducible cytokine subfamily C, member 2/SCYC2	*****	NM_00317 5	*****
small inducible cytokine subfamily D (Cys-X3-Cys), member 1/fractalkine/neurotactin/NTT/NTN/S CYD1	601880	NM_00299 6	16q
chemokine (C-C motif) receptor 1/MIP1A receptor/CCR1	601159	NM_00129 5	3p21
chemokine (C-C motif) receptor 2/MCP1 receptor/CCR2	601267	NM_00064 7	3p21
chemokine (C-C motif) receptor 3/eotaxin receptor/CCR3	601268	NM_00183 7	3p21.3
chemokine (C-C motif) receptor 4/CCR4	*****	NM_00550 8	*****

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C-Motif Chemokine Receptors	chemokine (C-C motif) receptor 5/CCR5	601373	NM_000579	3p21
	chemokine (C-C motif) receptor 6/G protein-coupled receptor 29/GPR29/CCR6	601835	NM_004367	6q27
	chemokine (C-C motif) receptor 7/epstein-barr virus induced gene 1/EBI1/CCR7	600242	NM_001838	17q12- q21.2
	chemokine (C-C motif) receptor 8/CCR8	601834	NM_005201	3p22
	chemokine (C-C motif) receptor 9/chemokine-binding protein 2/CCBP2/CCR9	602648	NM_006641	3p21.3
	chemokine (C-C motif) receptor 10/CCR10	*****	U94888	*****
	chemokine (C-X-C motif), receptor 3/G protein-coupled receptor 9/GPR9/CXCR3	600894	NM_001504	8p12-p11.2
	chemokine (C-X-C motif), receptor 4/fusin/CXCR4	162643	NM_003467	2q21
	chemokine (C-X3-C motif), receptor 1/fractalkine receptor/CX3CR1	601470	NM_001337	3pter-p21
	interleukin 8 receptor, alpha/IL8RA	146929	NM_0006634	2q35
	interleukin 8 receptor beta/IL8RB	146928	NM_001557	2q35
	chemokine (C motif) XC receptor 1/G protein-coupled receptor 5/GPR5/CCXCR1	600552	NM_005283	3p21.3- p21.1

Synthesis	macrophage migration-inhibitory factor (glycosylation-inhibiting factor)/AAIF	153620	NM_00241_5	22q11.2
	leukemia inhibitory factor/LIF	159540	NM_00230_9	22q12.1-q12.2
	oncostatin M	165095	AF129855	22q12.1-q12.2
	ciliary neurotrophic factor/CNTF	118945	NM_00061_4	11q12.2
	epidermal growth factor/EGF	131530	NM_00196_3	4q25
	pre-B cell stimulating factor homologue/SDF1A	600835	L36034	10q11.1
	cardiotrophin 1	600435	*****	*****
	mast cell growth factor/MGF	184745	NM_00399_4	12q22
	granulocyte-macrophage colony stimulating factor 2/CSF2	138960	NM_00075_8	5q31.1
	macrophage-specific colony-stimulating factor/CSF1	120420	AH005300	1p21-p13
Other Growth Factors	granulocyte colony stimulating factor 3/CSF3	138970	NM_00075_9	17q11.2-q12
	epidermal growth factor receptor EGFR	131550	NM_00522_8	7p12.3-p12.1
	ciliary neurotrophic factor receptor/CNTFR	118946	NM_00184_2	9p13
	oncostatin M receptor/OSMR	601743	NM_00399_9	*****
	neutrophil chemotactic response receptor/gp130	162820	*****	7q22-qter

Receptors	colony stimulating factor 1 receptor/CSFR1	164770	U63963	5q33.2-q33.3
	granulocyte-macrophage colony stimulating factor 2 receptor, alpha, low-affinity/CSF2RA	306250	NM_006140	Xp22.32
	granulocyte-macrophage colony stimulating factor 2 receptor, beta/CSF2RB	138981	U18373	22q12.2-q13.1
	granulocyte-macrophage colony stimulating factor 2 receptor, alpha, Y chromosomal/CSF2RY	425000	*****	Yp11
	myelocyte antigen CD105/endoglin/ENG/TGFB receptor component/CD105	131195	NM_000118	9q34.1
	leukocyte antigen CD 97/CD97	601211	NM_001784	19p13.2-p13.12
	signal transducer and activator of transcription 1/STAT 1	600555	*****	2q32.2-q32.3
	signal transducer and activator of transcription 2, 113kD/STAT2	600556	NM_005419	*****
	signal transducer and activator of transcription 3/STAT3	102582	NM_003150	17q21
	signal transducer and activator of transcription 6, interleukin-4 induced/STAT6	601512	NM_003153	12q13
	signal transducing adaptor molecule (SH3 domain and ITAM motif) 1/STAM	601899	NM_003473	10p14-p13
	STAM-like protein containing SH3 and ITAM domains 2/STAM2	*****	NM_005843	*****

interferon-stimulated transcription factor 3, gamma (48kD)/ISGF3G	147574	NM_006084	14q11.2
interferon, alpha-inducible protein 27/IFI27	600009	NM_005532	14q32
interferon, alpha-inducible protein (clone IFI-6-16)/GIP3	147572	NM_002038	1p35
Janus kinase 1 (protein tyrosine kinase)/JAK1	147795	NM_002227	1p31.3
Janus kinase 3 (protein tyrosine kinase)/JAK3	600173	NM_000215	19p13.1
interleukin-1 receptor-associated kinase M/IRAK-M	*****	NM_007199	*****
interleukin-1 receptor-associated kinase 1/IRAK1	601108	NM_001569	Xq28
interleukin-1 receptor-associated kinase 1/IRAK2	603304	NM_001570	*****
nuclear factor, interleukin 3 regulated/NFIL3	*****	NM_005384	*****
nuclear factor of activated T-cells, cytoplasmic 1/NFATC1	600489	NM_006162	18q23
nuclear factor of activated T-cells, cytoplasmic 2/NFATC2	600490	*****	20q13.2-q13.3
nuclear factor of activated T-cells, cytoplasmic 3/NFATC3	602698	L41066	16q13-q24
nuclear factor of activated T-cells, cytoplasmic 4/NFATC4	602699	L41067	*****
caspase 1, apoptosis-related cysteine protease (interleukin 1, beta, convertase)/CASP1	147678	NM_001223	11q22.2-q22.3

TGFB inducible early growth response/TIEG	601878	NM_005655	*****
TGFB inducible early growth response 2/TIEG2	603301	NM_003597	*****
eukaryotic translation initiation factor 3, subunit 8 (110kD)/EIF3S8	603911	NM_003752	1p34.1
MAD (mothers against decapentaplegic) homolog 1/MADH1	601595	NM_005900	4q28
homolog of Xenopus forkhead activin signal transducer-1 /FAST1	603621	NM_003923	8q24.3
interleukin 1 receptor accessory protein/IL1RAP	602626	NM_002182	3q28
CCAAT/enhancer binding protein (C/EBP), delta/CEBPD	189965	NM_005195	20q13.1
T-lymphocytes-specific interleukin 2 inhibitor/transcription factor 8/TCF8/	189909	U12170	10p11.2
cAMP responsive element binding protein 1/CREB1	123810	NM_004379	2q32.3-q34
interferon-stimulated transcription factor 3, gamma (48kD)/ISGF3G	147574	NM_006084	14q11.2
interferon regulatory factor 3/IRF3	603734	NM_001571	19q13.3-q13.4
lymphocyte specific interferon regulatory factor/LSIRF/interferon regulatory factor 4/IRF4	601900	U52683	6p25-p23
TNF receptor-associated factor 1/TRAF1	601711	NM_005658	9q33-q34
TNF receptor-associated factor 2/TRAF2	601895	U12597	9q34



Cytokine Response	Signaling and Transcription Factors	TNF receptor-associated factor 3/TRAF3	601896	NM_00330 0	*****
		TNF receptor-associated factor 4/TRAF4	602464	NM_00429 5	17q11-q12
		TNF receptor-associated factor 5/TRAF5	602356	AB000509	1q32
		TNF receptor-associated factor 6/TRAF6	602355	NM_00462 0	*****
		TRAF family member-associated NFKB activator/TANK	603893	NM_00418 0	2q24-q31
		mitogen activated protein kinase PRKM1/MAPK1	176948	NM_00274 5	22q11.2
		mitogen activated protein kinase PRKM3/MAPK3	601795	X60188	16p11.2
		mitogen activated protein kinase PRKM4/MAPK4	176949	NM_00274 7	18q12-q21
		mitogen activated protein kinase PRKM6/MAPK6	602904	NM_00274 8	*****
		mitogen activated protein kinase PRKM7/MAPK7	602521	NM_00274 9	17p11.2
		mitogen activated protein kinase JNK1/PRKM8/MAPK8	601158	L26318	*****
		mitogen activated protein kinase JNK2/PRKM9/MAPK9	602896	U09759	5q35
		mitogen activated protein kinase JNK3/PRKM10/MAPK10	602897	U35003	*****
		mitogen activated protein kinase PRKM11/MAPK11	602898	AF031135	*****
		mitogen activated protein kinase SAPK3/MAPK12	602399	NM_00296 9	22q13.3

mitogen activated protein kinase PRKM13/MAPK13	602899	NM_00275 4	*****
mitogen activated protein kinase SAPK2A/MAPK14	600289	NM_00131 5	6p21.3- p21.2
mitogen-activated protein kinase kinase 1/MAP2K1	176872	NM_00275 5	15q22.1- q22.33
mitogen-activated protein kinase kinase 2/MAP2K2	601263	L11285	*****
mitogen-activated protein kinase kinase 3/MAP2K3	602315	NM_00275 6	17q11.2
mitogen-activated protein kinase kinase 4/MAP2K4	601335	NM_00301 0	17p11.2
mitogen-activated protein kinase kinase 5/MAP2K5	602520	NM_00275 7	*****
mitogen-activated protein kinase kinase 6/MAP2K6	601254	U39065	*****
mitogen-activated protein kinase kinase 7/MAP2K7	603014	NM_00504 3	*****
protein kinase C alpha/PRKCA	176960	NM_00273 7	17q22- q23.2
protein kinase C beta/PRKCB	176970	X06318	16p11.2
protein kinase C, delta/PRKCD	176977	NM_00625 4	3p
protein kinase C gamma/PRKCG	176980	*****	19q13.4
protein kinase C, theta/PRKCT	600448	NM_00625 7	10p15
protein kinase C, zeta/PRKCZ	176982	NM_00274 4	*****
casein kinase 1 alpha 1	600505	NM_00189 2	13q13

casein kinase 1 gamma 2	602214	U9896	19p13.3
casein kinase 1 delta	600864	NM_00189 3	17q25
casein kinase 1 epsilon	600863	NM_00189 4	22q12-q13
casein kinase 2 alpha 1	115440	J02853	20p13
casein kinase 2 alpha 2	115442	NM_00189 6	16p13.3- p13.2
casein kinase 2 beta	115441	X57152	6p21.3
phosphatidylinositol 3-kinase, regulatory subunit, polypeptide 1 (p85, alpha)/PIK3R1	171833	M61906	5q13
phosphatidylinositol 3-kinase, regulatory subunit, polypeptide 2 (p85, beta)/PIK3R2	603157	NM_00502 7	19q13.2- q13.4
phosphatidylinositol 3-kinase, regulatory subunit, polypeptide 3 (p55, gamma)/PIK3R3	*****	NM_00362 9	*****
phosphoinositide-3-kinase, catalytic, alpha polypeptide/PIK3CA	171834	NM_00621 8	3q26.3
phosphoinositide-3-kinase, catalytic, beta polypeptide/PIK3CB	602925	NM_00621 9	*****
phosphatidylinositol 3-kinase, catalytic, delta polypeptide/PIK3CD	602839	NM_00502 6	1p36.2
phosphatidylinositol 3-kinase, catalytic, gamma polypeptide/PIK3CG	601232	NM_00264 9	*****
peptidyl-prolyl isomerase A/cyclophilin A/PP1A	123840	Y00052	7p13
peptidyl-prolyl isomerase B/cyclophilin B/PP1B	123841	M60857	chr. 15

Biosynthesis	peptidyl-prolyl isomerase C/cyclophilin C/PPIC	123842	S71018	*****
	peptidyl-prolyl isomerase D/cyclophilin D/PPID	601753	NM_005038	4q31.3
	peptidyl-prolyl isomerase E/cyclophilin E/PPIE	*****	NM_006112	*****
	peptidyl-prolyl isomerase-like/PPIL1	601301	AF090992	6p21.1
	FK506 binding protein 1A/immunophilin/FKBP1A	186945	NM_000801	20p13
	FK506 binding protein 2/immunophilin/FKBP2	186946	NM_004470	1q13.1-q13.2
Receptors	FK506 binding protein 4/immunophilin/FKBP4	600611	NM_002014	*****
	FK506 binding protein 5/immunophilin/FKBP5	602623	NM_004117	*****
	calcium modulating cyclophilin ligand/CAMLG	601118	NM_001745	5q23
	protein phosphatase 3, catalytic subunit, alpha isoform/calcineurin	114105	M29550	4q21-q24
	protein phosphatase 3, catalytic subunit, beta isoform/calcineurin	114106	M30773	10q21-q22
Response	protein phosphatase 3, catalytic subunit, gamma isoform/calcineurin	114107	NM_005605	Chr.8
	protein phosphatase 3, regulatory subunit B, alpha isoform/calcineurin	601302	*****	2p16-p15
	calmodulin 1/CALM1	114180	AH005370	14q24-q31
	calmodulin 2/CALM2	114182	NM_001743	2p21.3-p21.1
	calmodulin 3/CALM3	114183	NM_005184	9q13.2-q13.3

Non-Cytokine Mediated Immune Regulation	Biosynthesis	cytochrome P450, subfamily XXI (steroid 21-hydroxylase)/CYP21	201910	M13936	6p21.3
		cytochrome P450, subfamily XIB (steroid 18-beta-hydroxylase), polypeptide 2/CYP11B2	124080	NM_000498	8q21
Corticosteroids	Receptors and Signaling	cytochrome P450, subfamily XIB (steroid 11-beta-hydroxylase), polypeptide 1/CYP11B1	202010	NM_000497	8q21
		nuclear receptor subfamily 3, group C, member 1/NR3C1	138040	NM_000176	5q31
		melanocortin 2 receptor/ACTH receptor/MC2R	202200	NM_000529	18p11.2
		mineralocorticoid receptor/MCR/nuclear receptor subfamily 3, group C, member	600983	NM_000901	4q31.1
		heat shock 70kD protein 1/HSPA1A	140550	NM_005345	6p21.3
		heat shock 70kD protein-like 1/HSPA1L	140559	NM_005527	6p21.3
		heat shock 70kD protein 1/HSPA1B	603012	NM_005346	6p21.3
		heat shock 90-kD protein 1, alpha subunit/HSPCA	140571	*****	1q21.2-q22
		heat shock 90-kD protein 1, beta subunit/HSPCB	140572	J04988	6p12
		FK506-binding protein 4 (59kD)/FKBP4	600611	NM_002014	*****
		corticosteroid binding globulin precursor/CBG	122500	NM_001756	14q32.1
		hydroxy-D-5-steroid dehydrogenase, 3b- and steroid D-isomerase 2/HSD3B2	201810	NM_000198	1p13.1

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Metabolism	UDP glycosyltransferase 1/UGT1	191740	NM_00107 2	Chr. 12
	UDP glycosyltransferase family 2, member B4/UGT2B4	600067	NM_00107 3	4q13
	UDP glycosyltransferase family 2, member B7/UGT2B7	600068	NM_00107 4	1q14
	UDP glycosyltransferase 2 family, polypeptide B11/UGT2B11	603064	NM_00107 3	*****
	UDP glycosyltransferase family 2, member B15/UGT2B15	600069	NM_00107 6	4q13
	UDP glycosyltransferase family 2, member B17/UGT2B17	601903	NM_00107 7	1q14
	Dehydroepiandrosterone (DHEA)-preferring sulfotransferase, family 2A, member 1/SULT2A1	125263	NM_00316 7	19q13.3
	estrogen-preferring	600043	NM_005420	4q13.1
	vitamin D (1,25- dihydroxyvitamin D3) receptor/VDR	601769	NM_000376	12q12-q14
	Retinoic acid receptor, alpha/RARA	180240	NM_00096 4	17q12
Retinoic Acid	Retinoic acid receptor, beta/RARB	180220	NM_00096 5	3p24
	Retinoic acid receptor, gamma/RARG	180190	M57707	12q13
	T-cell antigen CD4/LEU3/CD4	186940	X87579	12pter-p12
	T-cell antigen CD6/T-cell differentiation antigen/CD6	186720	NM_00672 5	Chr.11
	lymphocyte antigen CD5/LEU1/CD5	153340	X04391	11q13
	thymocyte antigen CD7/Tp41/CD7	186820	NM_00613 7	17q25.2-q25.3

lymphocyte antigen CD19/B-lymphocyte antigen/CD19	107265	X13312	16p11.2
B-lymphocyte antigen CD28 (CD28 antigen ligand 1, B7-1 antigen)/CD80	112203	NM_00519 1	3q21
CD86 antigen (CD28 antigen ligand 2, B7-2 antigen)/CD86	601020	NM_00688 9	3q21
T-cell antigen CD28 (Tp44)/CD28	186760	NM_00613 9	2q33-q34
T-cell antigen receptor, beta subunit/TCRB	186930	AF011643	7q35
CD3G antigen, gamma polypeptide (TiT3 complex)/CD3G	186740	NM_00007 3	11q23
CD3D antigen, delta polypeptide (TiT3 complex)/CD3D	186790	NM_00073 2	11q23
CD3E antigen, epsilon polypeptide (TiT3 complex)/CD3E	186830	NM_00073 3	11q23
CD3Z antigen, zeta polypeptide (TiT3 complex)/CD3Z	186780	NM_00073 4	1q22-q23
leukocyte common antigen	151460	M23492	1q31-q32
T-cell antigen CD69/p60/CD69	107273	NM_00178 1	12p13-p12
lymphoblast antigen CD38/ADP-ribose cyclase/cyclic ADP-ribose hydrolase/CD38	107270	NM_00177 5	4p15
lymphoblast antigen CD39/vascular ATP diphosphohydrolase/CD39	601752	NM_00177 6	10q24
lymphocyte antigen CD73/5' nucleotidase/NT5'/CD73	129190	NM_00252 6	6q14-q21

## Receptors

## T-Cell

**Activation,  
Differentiation,  
and  
Proliferation**  
(excluding  
genes from  
cytokine  
section  
above)

leukocyte antigen CD23/low-affinity receptor II for Fc portion of IgE/FCER2/CD23	151445	NM_00200 2	19p13.3
macrophage antigen CD 64/high- affinity receptor IA for Fc fragment of IgG/FCGR1A	146760	Y10206	1q21.2- q21.3
lymphocyte antigen CD57/LEU7/CD57	151290	*****	Chr.11
lymphocyte function-associated antigen, type 3/LAF3/LEU7/CD58	153420	NM_00177 9	1p13
lymphocyte antigen CD45/protein tyrosine phosphatase, receptor type, c polypeptide/PTPRC/CD45	151460	NM_00283 8	1q31-q32
T-cell antigen receptor, gamma subunit/TCRG	186970	M17325	7p15-p14
T-cell antigen receptor, delta subunit/TCRD	186810	L36384	14q11.2
T-cell antigen CD8, alpha polypeptide (p32)/CD8A	186910	NM_00176 8	2p12
T-cell antigen CD8, beta polypeptide/CD8B	186730	AH003859	2p12
T-cell antigen CD28 (Tp44)/CD28	186760	NM_00613 9	2q33-q34
cytotoxic T-lymphocyte-associated 4/CTLA4	123890	L15006	2q33
T-cell antigen receptor, alpha subunit/TCRA	186880	Z24457	14q11.2
CD89 antigen/receptor for Fc fragment of IgA/FCAR/CD89	147045	NM_00200 0	19q13.4
T-cell activation antigen p250/TP250	186710	*****	11pter- p11.2

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Signaling	signaling lymphocytic activation molecule/SLAM	603492	NM_003037	*****
	T cell receptor-associated protein tyrosine kinase ZAP-70/ZAP70	176947	S69911	2q12
	v-mos Moloney murine sarcoma viral oncogene homolog/MOS	190060	NM_005372	8q11
	IL2-inducible T-cell kinase/ITK/T-cell tyrosine kinase EMT/EMT	186973	NM_005546	5q32
	mature T-cell proliferation 1/MTCP1	300116	Z24459	Xq28
	lymphocyte-specific protein tyrosine kinase/LCK	153390	NM_005356	1p35-p34.3
B-Cell Activation, Differentiation, and Proliferation (excluding genes from cytokine	B-cell antigen CD20/B-lymphocyte differentiation antigen B1/CD20	112210	AH003353	11q13
	B-cell antigen CD72/CD72	107272	NM_001782	9p
	natural resistance-associated macrophage protein 1/NRAMP1/solute carrier family 11, natural resistance-associated	600266	AH002806	2q35
	macrophage protein 2/NRAMP2/solute carrier family 11, natural resistance-associated	600523	AB015355	12q13
	T-lymphocyte antigen CDW52 (CAMPATH-1 antigen)/CDW52	114280	NM_001803	*****
	B-cell antigen CD22/CD22	107266	NM_001771	19q13.1
	B-cell antigen CD24/CD24	600074	X69397	6q21
	B-cell antigen CD40/tumor necrosis factor receptor superfamily, member 5/CD40/TNFRSF5	109535	NM_001250	20q12-q13.2
Receptors				

section above)	leukocyte antigen CD156/disintegrin and metalloprotease domain 8/ADAM8/CD156	602267	NM_00110 9	10q26.3
	platelet antigen CD151/platelet- endothelial cell tetraspan antigen 3/PETA3/CD151	602243	NM_00435 7	11p15.5
	IIA for Fc fragment of IgG/FCGR2A/CD32	146790	NM_00400 1	1q21-q23
	activated leucocyte cell adhesion molecule/CD6 ligand/ALCAM	601662	NM_00162 7	3q13.1- q13.2
	regulator of G-protein signaling 1/RGS1	600323	NM_00292 2	1q31
Growth Factors	macrophage-specific colony- stimulating factor/CSF1	120420	AH005300	1p21-p13
	granulocyte-macrophage colony stimulating factor 2/CSF2	138960	NM_00075 8	5q31.1
	granulocyte colony stimulating factor 3/CSF3	138970	NM_00075 9	17q11.2- q12
	colony stimulating factor 1 receptor/CSFR1	164770	U63963	5q33.2- q33.3
Myeloid Progenitor Cell Differentiation on and Proliferation (excluding genes from cytokine	granulocyte-macrophage colony stimulating factor 2 receptor, alpha, Y chromosomal/CSF2RY	425000	*****	Yp11
	granulocyte-macrophage colony stimulating factor 2 receptor, alpha, low-affinity/CSF2RA	306250	NM_00614 0	Xp22.32
	granulocyte-macrophage colony stimulating factor 2 receptor, beta/CSF2RB	138981	U18373	22q12.2- q13.1

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section above)	Signaling	CCAAT/enhancer binding protein (C/EBP), beta/CEBPB	189965	NM_005194	20q13.1
		CCAAT/enhancer binding protein (C/EBP), epsilon/CEBPE	600749	NM_001805	14q11.2
		flt3 ligand/FMS-related tyrosine kinase 3 ligand/FLT3LG	600007	U03858	19q13.3
		FMS-related tyrosine kinase 3/FLT3	136351	NM_004119	13q12
		myeloid differentiation primary response gene (88)/MYD88	602170	NM_002468	3p22-p21.3
		BCL2	151430	M13994	18q21.3
		BCL-X/BCLX	600039	Z23115	*****
		BCL2 associated protein/BAX	600040	L22473	19q13.3- q13.4
		BCL2-antagonist/killer 1/BAK1	600516	NM_001188	6p21.3- p21.2
		BCL2-associated athanogene 1/BAG1	601497	NM_004323	9p12
		BCL2-associated athanogene 2/BAG2	603882	NM_004282	*****
		BCL2-associated athanogene 3/BAG3	603883	AF095193	*****
		BCL2-associated athanogene 4/BAG4	603884	AF095194	*****
		BCL2-associated athanogene 5/BAG5	603885	AF095195	*****
		BCL-X/BCL-2 binding protein/BAD	603167	AF021792	*****
		BCL2-like 1/BCL2L1	600039	NM_001119	*****
		BCL2-like 2/BCL2L2	601931	NM_004050	14q11.2- q12
		BCL2-like 11 (apoptosis facilitator)/BCL2L11	603827	NM_006553	*****

BCL2-related protein A1/BCL2A1	601056	Y09397	15q24.3
BCL2-interacting protein harikari/HRK	603447	NM_00380 6	*****
Bcl-2 interacting killer/BIK	603392	U34584	*****
tumor protein p53/TP53	191170	X02469	17p13.1
superfamily, member 6/FAS/TNFRSF6	134637	NM_000004 3	10q24.1
nuclear factor kappa-B DNA binding subunit 1/NFKB1	164011	M58603	4q23-q24
nuclear factor kappa-B DNA binding subunit 2/NFKB2	164012	NM_00250 2	10q24
apoptosis-related cysteine protease 1/caspase 1/CASP1	147678	L27475	11q22.2- q22.3
apoptosis-related cysteine protease 1/caspase 1/CASP2	600639	*****	7q35
apoptosis-related cysteine protease 1/caspase 1/CASP3	600636	NM_00434 6	4q35, 4q33 q35.1
apoptosis-related cysteine protease 1/caspase 1/CASP4	602664	NM_00434 7	11q22.2- q22.3
apoptosis-related cysteine protease 1/caspase 1/CASP5	602665	NM_00434 7	11q22.2- q22.3
apoptosis-related cysteine protease 1/caspase 1/CASP6	601532	NM_00122 6	4q25-q25
apoptosis-related cysteine protease 1/caspase 1/CASP7	601761	NM_00122 7	10q25.1- q25.2
apoptosis-related cysteine protease 1/caspase 1/CASP8	601763	NM_00122 8	2q33-q34
apoptosis-related cysteine protease 1/caspase 1/CASP9	602234	*****	*****

**Apoptosis**  
(additional  
genes in  
Oncology)

**Apoptosis**

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Cell-Mediated Inflammation	apoptosis-related cysteine protease 1/caspase 1/CASP10	601762	NM_001230	2q33-q34
	apoptosis-related cysteine protease 1/caspase 1/CASP13	603653	NM_003723	*****
	ADP-ribosyltransferase (NAD <sup>+</sup> ; poly (ADP-ribose) polymerase)/PARP/ADPRT	173870	NM_001618	1q42
	poly (ADP-ribose) glycohydrolase/PARG	603501	NM_003631	10q11.23
	lymphocyte antigen CD11A/integrin, alpha-L/CD11A/ITGAL	153370	NM_002209	16p11.2
	lymphocyte antigen CD11B/integrin, alpha-M/CD11B/ITGAM	120980	NM_000632	16p11.2
	lymphocyte antigen CD11C/integrin, alpha-X/CD11C/ITGAX	151510	NM_000887	16p11.2
	lymphocyte antigen CD11D/integrin, alpha-D/CD11D/ITGAD	602453	NM_005353	16p11.2
	antigen CD51/integrin, alpha-V/vitronectin receptor/CD51/ITGAV	193210	NM_002210	2q31-q32
	integrin, alpha 1/ITGA1	192968	*****	Chr.5
	integrin, alpha 2/ITGA2	192974	NM_002203	5q23-q31
	integrin, alpha 3/ITGA3	*****	NM_005501	*****
	integrin, alpha 4/ITGA4	192975	NM_000885	2q31-q32
	integrin, alpha5/fibronectin receptor, alpha subunit/FNRA/ITGA5	135620	NM_002205	12q11-q13
	integrin, alpha 6/ITGA6	147556	NM_000210	Chr.2

Integrins	integrin, alpha 7/ITGA7	600536	NM_002206	12q13
	integrin, alpha 8/ITGA8	604063	L36531	*****
	integrin, alpha 9/ITGA9	603963	L24158	3p21.3
	integrin, alpha 10/ITGA10	604042	NM_003637	*****
	antigen CD29/integrin, beta-1/CD29/ITGB1	135630	NM_002211	10p11.2
	leukocyte antigen CD18/integrin beta chain, beta 2/CD18/ITGB2	600065	NM_000211	21q22.3
	platelet antigen CD61/integrin, beta-3/CD61/ITGB3	173470	NM_000212	17q21.32
	integrin, beta 5/ITGB5	147561	NM_002213	*****
	integrin, beta 6/ITGB6	147558	NM_000888	Chr.2
	integrin, beta 7/ITGB7	147559	NM_000889	12q13.13
Selectins	integrin, beta-like 1 (with EGF-like repeat domains)/ITGBL1	604234	NM_004791	13q33
	erythrocyte antigen CD47/Rh-related antigen, integrin-associated signal transducer/CD47	601028	NM_001777	3q13.1-q13.2
	integrin-linked kinase/ILK	602366	NM_004517	11p15.5-p15.4
	selectin E/endothelial adhesion molecule 1/ELAM1/SELE	131210	NM_000450	1q23-q25
	granulocyte antigen CD62/platelet alpha-granule membrane protein/selectin P/CD62/SELP	173610	NM_003005	1q23-q25

	selectin L/lymphocyte adhesion molecule 1/LAM1/SELL	153240	NM_000655	1q23-q25
Adhesion and Migration	T-cell antigen CD8, alpha polypeptide (p32)/LEU2/CD8A	186910	NM_001768	2p12
	T-cell antigen CD8, beta polypeptide/CD8B	186730	AH003859	2p12
	leukocyte antigen CD9/MIC3/CD9	143030	NM_001769	12p13
	activated leucocyte cell adhesion molecule/CD6 ligand/ALCAM	601662	NM_001627	3q13.1-ql3.2
	mucosal addressin cell adhesion molecule-1/MACAM1	102670	NM_007164	19p13.3
	platelet antigen CD151/platelet-endothelial cell tetraspan antigen 3/PETA3/CD151	602243	NM_004357	11p15.5
	CD36/thrombospondin receptor/platelet collagen	173510	NM_000072	7q11.2
	leukocyte antigen CD37/CD37	151523	NM_001774	19p13-ql3.4
	platelet antigen CD31/platelet-endothelial cell adhesion molecule 1/PECAM1/CD31	173445	NM_000442	17q23
	T-cell antigen CD26/dipeptidylpeptidase 4/CD26	102720	NM_001935	2q23
	lymphocyte antigen CD44/hermes antigen/CD44	107269	AF098641	11pter-p13
	B-cell antigen CD 48/B-cell activation marker/BCM1/BLAST1	109530	NM_001778	1q21.3-q22
	leukocyte antigen CD53/tetraspan antigen/CD53	151525	AJ243474	1p21-p13.3

B-cell antigen CD54/intercellular adhesion molecule 1/ICAM1/CD54	147840	NM_000201	19p13.3-p13.2
intercellular adhesion molecule 2/ICAM2	146630	NM_000873	17q23-q25
intercellular adhesion molecule 3/ICAM3	146631	NM_002162	19p13.3-p13.2
myeloid antigen CD33/p67/CD33	159590	NM_001772	19q13.3-q13.4
granulocyte antigen CD66/biliary glycoprotein/CD66	109770	NM_001712	19q13.2
leukocyte antigen CD81/target of antiproliferative antibody 1/TAPA1/CD81	186845	NM_004356	11p
leukocyte antigen CD82/R2/suppression of tumorigenicity 1/STP1/CD82	600623	NM_002231	11p11.2
killer cell lectin-like receptor subfamily B, member 1/KLRB1	602890	NM_002258	12p13-p12
killer cell lectin-like receptor subfamily C, member 1/KLRC1	161555	NM_002259	12p13.2-p12.3
killer cell lectin-like receptor subfamily C, member 2/KLRC2	602891	NM_002260	12p13.2-p12.3
killer cell lectin-like receptor subfamily C, member 3/KLRC3	602892	NM_002261	12p13.2-p12.3
killer cell lectin-like receptor subfamily C, member 4/KLRC4	602893	NM_003497	12p13.2-p12.3
killer cell antigen CD94/killer cell lectin-like receptor subfamily D, member 1/KLRD1/CD94	602894	NM_002262	12p13.2-p12.3
T-cell antigen CD99/MIC2/CD99	313470	NM_002414	Xpter-p22.32

**Other  
Adhesion  
Molecules**



	leukocyte antigen CD100/semaphorin 4D/SEMA4D/CD100	601866	NM_006378	9q22-q31
	hematopoietic progenitor cell antigen CD34/CD34	142230	AH000040	1q32
	macrophage antigen CD68/macrosialin/CD68	153634	NM_001251	17p13
	cadherin 2, N-cadherin (neuronal)/CDH2	114020	NM_001792	18q11.2
	receptor for advanced glycation end products/RAGE	600214	AJ133822	6p21.3
	leukocyte antigen CD43/sialophorin/SPN/CD43	182160	NM_003123	16p11.2
	vascular cell adhesion molecule 1/VCAM1	192225	NM_001078	1p32-p31
	UDP-Gal:betaGlcNAc beta 1,4-galactosyltransferase, polypeptide 1/B4GALT1	137060	NM_001497	9p13
	UDP-Gal:betaGlcNAc beta 1,4-galactosyltransferase, polypeptide 2/B4GALT2	604013	NM_003780	1p33-p32
	UDP-Gal:betaGlcNAc beta 1,4-galactosyltransferase, polypeptide 3/B4GALT3	604014	NM_003779	1q23
	UDP-Gal:betaGlcNAc beta 1,4-galactosyltransferase, polypeptide 4/B4GALT4	604015	AF038662	3q13.3
	UDP-Gal:betaGlcNAc beta 1,4-galactosyltransferase, polypeptide 5/B4GALT5	604016	NM_004776	Chr.11
Glycosyltransferases	Glycosyltransferases			

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UDP-Gal:betaGlcNAc beta 1,4-galactosyltransferase, polypeptide 6/B4GALT6	604017	AF038664	18q11
myeloid antigen	104230	NM_002033	11q21
CD15/fucosyltransferase	173391	NM_002659	19q13
monocyte antigen CD87/plasminogen activator receptor, urokinase type/PLAUR/CD87	120520	NM_000902	3q21-q27
lymphocyte antigen CD10/membrane metalloendopeptidase/MME/CD10	151530	NM_001150	15q25-q26
leukocyte antigen CD13/alanyl aminopeptidase/ANPEP/CD13	118938	NM_001836	14q11.2
chymase 1, mast cell/CMA1	191080	NM_003293	Chr.16
tryptase alpha/TPS1	120353	NM_002421	11q22-q23
matrix metalloproteinase 1 (interstitial collagenase)/MMP1	*****	NM_004142	*****
matrix metalloproteinase-like 1/MMPL1	120360	AH002654	16q13
matrix metalloproteinase 2 (neutrophil gelatinase)/CLG4/MMP2	185250	NM_002422	11q23
matrix metalloproteinase 3 (stromelysin 1, progelatinase)/MMP3	120355	NM_002424	11q21-q22
matrix metalloproteinase 8 (neutrophil collagenase)/MMP8			
matrix metalloproteinase 9 (gelatinase B, 92kD gelatinase, 92kD type IV collagenase)/MMP9	120361	NM_004994	20q11.2-q13.1
matrix metalloproteinase 10 (stromelysin 2)/MMP10	185260	NM_002425	11q22.3-q23

Proteases

Proteases and Inhibitors	matrix metalloproteinase 11 (stromelysin 3)/MMP11	185261	NM_005940	22q11.2
	matrix metalloproteinase 12 (macrophage elastase)/MMP12	601046	NM_002426	1q22.2-q22.3
	matrix metalloproteinase 13 (collagenase 3)/MMP13	600108	NM_002427	11q22.3
	matrix metalloproteinase 14 (membrane-inserted)/MMP14	600754	NM_004995	14q11-q12
	matrix metalloproteinase 15 (membrane-inserted)/MMP15	602261	NM_002428	16q13-q21
	matrix metalloproteinase 16 (membrane-inserted)/MMP16	602262	NM_005941	8q21
	matrix metalloproteinase 17 (membrane-inserted)/MMP17	602285	NM_004141	12q24.33
	matrix metalloproteinase 19/MMP19	601807	NM_002429	12q14
	matrix metalloproteinase 23A/MMP23A	603320	NM_004659	1p36.3
	matrix metalloproteinase 23B/MMP23B	603321	NM_006983	1p36.3
	matrix metalloproteinase 24 (membrane-inserted)/MMP24	*****	NM_006690	*****
	tryptase beta/TPS2	191081	NM_003294	Chr.16
	tissue inhibitor of metalloproteinase 1/erythroid potentiating activity/EPA/human collagenase inhibitor/HCI/TIMP1	305370	NM_003254	Xp11.3- p11.23
	secretory leukocyte protease inhibitor (antileukoproteinase)/SLPI	107285	NM_003064	*****
	Inhibitors			

Cell-Mediated Pathogen Defense	Phagocytosis of Pathogens	Scavenger Receptors	monocyte/neutrophil elastase inhibitor/ELANH2	130135	M93056	6pter-p24
			alpha-1-microglobulin/bikunin precursor/AMBP	176870	NM_001633	9q32-q33
			alpha-2-macroglobulin/A2M	103950	NM_000014	2p13.3-p12.3
			CD36/thrombospondin receptor/platelet collagen	173510	NM_00007	7q11.2
			CD36 antigen (collagen type I receptor, thrombospondin receptor)-like 1/CD36L1/SRB1	601040	NM_00550	Chr. 12
			CD5 antigen-like (scavenger receptor cysteine rich family)/CD5L	602592	NM_005894	1q21-q23
			acetyl LDL receptor/scavenger receptor expressed by endothelial	*****	NM_003693	*****
			macrophage scavenger receptor 1/MSR1	153622	NM_002445	8p22
			macrophage scavenger receptor 1-like/MSRL1	602728	*****	8p21
			mannose receptor, C type 1/MRC1	153618	NM_002438	10p13
			endocytic receptor (macrophage mannose receptor family) (KIAA0709)	*****	NM_006039	*****
			toll-like receptor 1/TLR1	601194	NM_003263	4p14
			toll-like receptor 2/TLR2	603028	NM_003264	4q32
			toll-like receptor 3/TLR3	603029	NM_003265	4q35
			toll-like receptor 4/TLR4	603030	NM_003266	9q32-q33
			toll-like receptor 5/TLR5	603031	NM_006068	1q41-q42
			collectin 34	*****	AB002631	*****
			liver collectin 1/CL-L1	*****	NM_006438	*****
			collectin receptor/complement component C1q receptor/C1QR	120577	*****	

		surfactant, pulmonary-associated protein D/SFTPD	178635	NM_003019	10q23.3
		surfactant, pulmonary-associated protein A1/SFTPA1	178630	NM_005411	0q22.2-q23.1
Immunoglobulin Light Chains	Kappa Light Chain	immunoglobulin K light chain constant region locus/IGKC	147200	*****	2p12
		immunoglobulin K light chain variable region locus/IGKV	146980	K01322	2p12
		immunoglobulin K light chain joining region locus/IGKJ	146970	*****	2p12
	Lambda Light Chain	immunoglobulin L light chain constant region locus/IGLC1	147220	NM_006146	22q11.2
		immunoglobulin L light chain joining region locus/IGLJ	147230	NM_006146	22q11.2
		immunoglobulin L light chain variable region locus/IGLJ	147240	NM_006146	22q11.2
	IgA Heavy Chain Constant Region	immunoglobulin A heavy chain constant region locus 1/IGHA1	146900	*****	14q32.33
		immunoglobulin A heavy chain constant region locus 2/IGHA2	147000	*****	14q32.33
	IgD Heavy Chain Constant Region Locus	immunoglobulin D heavy chain constant region locus/IGHD	147170	*****	14q32.33

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<b>IgE Heavy Chain Constant Region Locus</b>	immunoglobulin E heavy chain constant region locus/IGHG1	147180	*****	14q32.33
<b>IgG Heavy Chain Constant Region Locus</b>	immunoglobulin G heavy chain constant region locus 1/IGHG1	147100	*****	14q32.33
	immunoglobulin G heavy chain constant region locus 2/IGHG2	147110	*****	14q32.33
	immunoglobulin G heavy chain constant region locus 3/IGHG3	147120	*****	14q32.33
	immunoglobulin G heavy chain constant region locus 4/IGHG4	147130	*****	14q32.33
<b>IgM Heavy Chain Constant Region Locus</b>	immunoglobulin M heavy chain constant region locus/IGHM	147020	*****	14q32.33
<b>Heavy Chain Variable Region Locus</b>	immunoglobulin heavy chain variable region locus 1/IGHV1	147070	X92279	14q32.33
	immunoglobulin heavy chain variable region locus 2/IGHV2	600949	*****	16p11
<b>Heavy Chain Diversity Region Locus</b>	immunoglobulin heavy chain diversity region locus 1/IGHDY1	146910	X97051	14q32.33
	immunoglobulin heavy chain diversity region locus 2/IGHDY2	146990	L25544	15q11-q12

Immunoglobulin Heavy Chains

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Immunoglobulin Gene Rearrangement	Heavy Chain Joining Region Locus	Immunoglobulin heavy chain joining region locus/IGHJ	147010	*****	14q32.33
Immunoglobulin Gene Rearrangement	Signaling	recombination activating gene 1/RAG1	179615	NM_000448	11p13
		recombination activating gene 2/RAG2	179616	M94633	11p13
		immunoglobulin kappa J region recombination signal binding protein/RBPJK/IGKJRB1	147183	L07872	9p13-p12
		Bruton agammaglobulinemia tyrosine kinase/BTK	300300	NM_000061	Xq21.3-q22
		interleukin 7 receptor/IL7R	146661	NM_002185	5p13
		interferon-gamma receptor 1/IFNGR1	107470	NM_000416	6q23-q24
		interferon-gamma receptor 2/IFNGR2	147569	NM_005534	21q22.1-q22.2
		interleukin 4 receptor precursor/IL4R	147781	NM_000418	16p12.1-p11.2
		interleukin 4 receptor precursor/IL4R	147781	NM_000418	16p12.1-p11.2
		ligase I, DNA, ATP-dependent/LIG1	126391	NM_000234	19q13.2-q13.3
		ligase IV, DNA, ATP-dependent/LIG4	601837	NM_002312	13q22-q34
		X-ray repair, complementing defect in Chinese hamster/Ku antigen, 80 kD/KU80/XRCC5	194364	*****	2q35
	Recombination				

	thyroid autoantigen, 70 kD/KU7C/G22P1	152690	NM_00146 9	22q11-q13
Immunoglobulin Gene Transcription Factors	nuclear factor kappa-B DNA binding subunit 1/NFKB1	164011	M58603	4q23-q24
	nuclear factor kappa-B DNA binding subunit 2/NFKB2	164012	NM_00250 2	10q24
	nuclear factor kappa-B subunit 3/NFKB3	164014	Z22949	11q12-q13
	nuclear factor of kappa light chain gene enhancer in B cells, inhibitor alpha/NFKBIA	164008	*****	14q13
	nuclear factor of kappa light chain gene enhancer in B cells, inhibitor beta/NFKBIB	603258	NM_00250 3	8p11.2
	YY1 transcription factor/YY1	600013	NM_00340 3	14q
	immunoglobulin transcription factor 1/ITF1/transcription factor 3/TCF3	147141	*****	19p13.3
	immunoglobulin transcription factor 2/ITF2/transcription factor 4/TCF4	602272	NM_00319 9	18q21.1
	immunoglobulin mu binding protein 2/IGHMBP2	600502	NM_00218 0	11q13.2- q13.4
	transcription factor binding to IGHM enhancer 3/TFE3	314310	NM_00652 1	Xp11.22
	homeobox protein OCT1/POU domain transcription factor 2, class 1/POU2F1	164175	NM_00269 7	1q22-q23
	homeobox protein OCT2/POU domain transcription factor 2, class 2/POU2F2	164176	M22596	Chr.19
	POU domain, class 2, associating factor 1/POU2AF1	601206	NM_00623 5	11q23.1



			inhibitor of DNA binding 1, dominant negative helix-loop-helix protein/ID1	600349	NM_002165	20q11
			inhibitor of DNA binding 2, dominant negative helix-loop-helix protein/ID2	600386	NM_002166	2p25
Immunoglobulin Isotype Switching	Signaling		B-cell antigen CD40/tumor necrosis factor receptor superfamily, member 5/CD40/TNFRSF5	109335	NM_001250	20q12-q13.2
			paired box gene 5/B-cell lineage-specific activator protein/BSAP/PAX5	167414	*****	9p13
			lymphocyte function-associated antigen, type 3/LFA3/LEU7/CD58	153420	NM_001779	1p13
			interleukin 10 receptor, alpha/IL10RA	146933	NM_001558	11q23.3
			lymphocyte antigen CD45/protein tyrosine phosphatase, receptor type, c polypeptide/PTPRC/CD45	151460	NM_002838	1q31-q32
			prostaglandin E receptor 1, EP1 subtype/PTGER1	176802	NM_000955	19p13.1
			prostaglandin E receptor 2, EP2 subtype/PTGER2	176804	*****	5p13.1
			prostaglandin E receptor 3, EP3 subtype/PTGER3	176806	NM_000957	1p31.2
			prostaglandin E receptor 4, EP4 subtype/PTGER4	601586	NM_000958	5p13.1
			interleukin 13 receptor, alpha 1/IL13RA1	300119	NM_001560	Chr.X
			interleukin receptor 13 alpha2/IL13A2	300130	X95302	Xq24
			interferon-gamma receptor 1/IFNGR1	107470	NM_000416	6q23-q24

Defense Proteins and Peptides	Recombination	interferon-gamma receptor 2/IFNGR2	147569	NM_00553 4	21q22.1- q22.2
		interleukin 5 receptor alpha/IL5RA	147851	M96652	3p26-p24:
		transforming growth factor, beta receptor I (activin A receptor type II- like kinase, 53kD)/TGFBRI	190181	NM_00461 2	9q33-q34
		transforming growth factor, beta receptor II (70-80kD)/TGFBRI2	190182	NM_00324 2	3p22
		transforming growth factor, beta receptor III (betaglycan, 300kD)/TGFBRI3	600742	NM_00324 3	1p33-p32
		X-ray repair, complementing defect in Chinese hamster/Ku antigen, 80 kD/KU80/XRCC5	194364	*****	2q35
		thyroid autoantigen, 70 kD/KU70/G22P1	152690	NM_00146 9	22q11-q13
		complement component 1, R subcomponent/C1R	216950	NM_00173 3	12p13
		complement component 1, S subcomponent/C1S	120580	NM_00173 4	12p13
		complement component 1, Q subcomponent, alpha polypeptide/C1QA	120550	*****	1p36.3- p34.1
		complement component 1, Q subcomponent, beta polypeptide/C1QB	120570	*****	1p36.3- p34.1
		complement component 1, Q subcomponent, gamma polypeptide/C1QG	120575	*****	1p36.3- p34.1
		complement component 1, Q subcomponent binding protein/C1QBP	601269	NM_00121 2	17p13.3

complement component 1 inhibitor (angioedema, hereditary) /C1NH	106100	NM_00006 2	11q11- q13.1
complement component 2/C2	217000	NM_00006 3	6p21.3
complement component 3/C3	120700	NM_00006 4	19p13.3- p13.2
complement component 4B/C4B	120820	NM_00059 2	6p21.3
complement component 5/C5	120900	NM_00173 5	9q34.1
complement component 6/C6	217050	NM_00006 5	5p13
complement component 7/C7	217070	NM_00058 7	5p13
complement component 8, alpha polypeptide/C8A	120950	NM_00056 2	1p32
complement component 8, beta polypeptide/C8B	120960	NM_00006 6	1p32
complement component 8, gamma polypeptide/C8G	120930	NM_00060 6	9q34.3
complement component 9/C9	120940	NM_00173 7	5p13
complement factor H/H factor 1/HF1	134370	NM_00018 6	1q32
I factor (complement)/IF	217030	NM_00020 4	4q25
decay-accelerating factor for complement/DAF/CD55	125240	S72858	1q32
perforin 1/preforming protein/PRF1	170280	NM_00504 1	10q22

**Classical  
Pathway**

**Complement**

leukocyte antigen p18-20/protectin/CD59	107271	M95708	11p13
T-cell antigen CD46/membrane cofactor protein/MCP/measels virus receptor/CD46	120920	Y07713	1q32
erythrocyte antigen CD55/decay-accelerating factor for complement/DAF/CD55	125240	S72858	1q32
leukocyte antigen p18-20/protectin/CD59	107271	M95708	11p13
erythrocyte antigen CD35/complement receptor CR1 (receptor for components C3b/C4b)/CD35/CR1	120620	AH002679	1q32
complement component 3a receptor 1/C3AR1	*****	NM_004054	*****
complement component 4-binding protein, alpha/C4BPA	120830	NM_000715	1q32
complement component 4-binding protein, beta/C4BPB	120831	NM_000716	1q32
complement component 5 receptor 1 (C5a ligand)/C5AR1	113995	NM_001736	Chr.19
antigen CD21/CD21	*****	X98257	*****
B-factor, properdin/BF	138470	NM_001710	6p21.3
properdin P factor, complement/PFC	312060	NM_002621	Xp11.4-p11.23
adipsin/complement factor D precursor/DF	134350	NM_001928	*****
Alternative Pathway			

Acute Protection from	Defensins and Related Protective Proteins	defensin, alpha 1, myeloid-related sequence/DEFA1	125220	NM_00408 4	8p23.2- p23.1
		defensin, alpha 3, neutrophil- specific/DEFA3	*****	NM_00521 7	*****
		defensin, alpha 4/corticostatin/DEFA4	601157	NM_00192 5	Chr.8
		defensin, alpha 5/DEFA5	600472	M97925	8pter-p21
		defensin, alpha 6, Paneth cell- specific/DEFA6	600471	NM_00192 6	8pter-p21
		defensin, beta 1/DEFB1	602056	NM_00521 8	8p23.2- p23.1
		defensin, beta 2/DEFB2	602215	NM_00494 2	8p23.1-p22
		ribonuclease, RNase A family, 2/eosinophil-derived neurotoxin/EDN/RNASE2	131410	NM_00293 4	14q24-q31
		ribonuclease, RNase A family, 3/eosinophil cationic protein/ECP/RNASE3	31398	NM_00293 5	14q24-q31
		myeloperoxidase/MPO	254600	J02694	17q23.1
		eosinophil peroxidase/EPX	131399	NM_00050 2	*****
		cathelicidin antimicrobial peptide/CAMP	600474	NM_00434 5	3p21.3
		lysozyme/LYZ	153450	NM_00023 9	Chr.12
		chitinase 1/CHIT1	600031	NM_00346 5	1q31-q32
		lactotransferrin/LTF	150210	NM_00234 3	3q21-q23

Human Pathogens	polyadenylate binding protein/TIA1	603518	M77142	2p13
	TIA1 cytotoxic granule-associated RNA-binding protein-like 1/TIAL1	603413	NM_00325_2	10q
	granulysin/NKG5	603082	NM_00643_3	2p12-q11
	neutrophil azurocidin/NAZC	162815	M96326	19p13.3
	bactericidal/permeability-increasing protein precursor/BPI	109195	NM_00172_5	20q11.23-q12
	lipopolysaccharide-binding protein/LBP	151990	AF105067	20q11.23-q12
	monocyte antigen CD14/monocyte differentiation antigen/CD14	158120	NM_00059_1	5q31.1
	proteoglycan 1, secretory granule/serglycin/PRG1	177040	NM_00272_7	10q22.1
	proteoglycan 2, bone marrow/natural killer cell activator, eosinophil granule major basic protein/PRG2	*****	NM_00272_8	*****
	prepro-major basic protein homolog/MBPH	*****	NM_00609_3	*****
Pentraxins	neuronal pentraxin I/NPTX1	602367	NM_00252_2	17q25.1-q25.2
	neuronal pentraxin II/NPTX2	600750	U26662	7q21.3-q22.1
	pentaxin-related gene, rapidly induced by IL-1 beta/PTX3	602492	NM_00285_2	3q25
	amyloid P component, serum/APCS	104770	NM_00163_9	1q21-q23
	C-reactive protein, pentraxin-related/CRP	123260	X56214	1q21-q23

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Degranulation of Platelets, Mast Cells, Neutrophils, and Eosinophils	Receptors	mast cell IgE receptor alpha polypeptide/FCER1A	147140	*****	1q23
		mast cell IgE receptor beta polypeptide/FCER1B	147138	NM_000139	11q13
		mast cell IgE receptor beta polypeptide/FCER1G	147139	NM_004106	1q23
		granulocyte antigen CD62/platelet alpha-granule membrane protein/selectin P/CD62/SELP	173610	NM_003005	1q23-q25
		neutrophil antigen CD16/low-affinity receptor IIIA for Fc fragment of IgG/FCGR3A/CD16	146740	M24853	1q23
		prostaglandin I2 receptor/PTGIR/prostacyclin receptor	600022	SEG_HUMIF	19q13.3
		formyl peptide receptor 1/FPRL1	136537	NM_002029	Chr.19
		formyl peptide receptor-like 1/FPRL1	136538	NM_001462	19q13.3-q13.4
		formyl peptide receptor-like 2/FPRL2	136539	NM_002030	19q13.3-q13.4
		lipoxin A4 receptor	*****	AF054013	*****
	Signaling	inositol polyphosphate-5-phosphatase, 145 kD/SH2-containing inositol 5-phosphatase/SHIP/INPP5D	601582	NM_005541	2q36-q37
		v-src-1 Yamaguchi sarcoma viral related oncogene homolog/LYN	165120	NM_002350	8q13-qter
		guanine nucleotide binding protein (G protein), q polypeptide/GNAQ	600998	NM_002072	9q21

Release of Membrane Lipids (common to PAF, lipoxin, leukotriene, and prostaglandin pathways)	guanine nucleotide binding protein (G protein), alpha inhibiting activity, polypeptide 2/GNAI2	139360	NM_002070	3p21
	phospholipase A2 group	172411	NM_000300	1p35
	phospholipase A2 group IB/PLA2G1B	172410	NM_000928	12q23-q24.1
	phospholipase A2 group X/PLA2G10	603603	NM_003561	16p13.1-p12
	phospholipase A2 group IVA/PLA2G4A	600522	U08374	1q25
	phospholipase A2 group VI/PLA2G6	603604	AF064594	22q13.1
	phospholipase A2 group IVC/PLA2G4C	603602	NM_003706	chr. 19
	phospholipase A2 group V/PLA2G5	601192	NM_000929	1p36-p34
	phospholipase C, beta 2/PLCB2	604114	NM_004573	15q15
	phospholipase C, beta 3/PLCB3	600230	U26425	11q13
	phospholipase C, beta 4/PLCB4	600810	NM_000933	20p12
	phospholipase C, delta 1/PLCD1	602142	NM_006225	3p22-p21.3
	phospholipase C, epsilon/PLCE	600597	NM_006226	2q33
	phospholipase C, gamma 1 (formerly subtype 148)/PLCG1	172420	NM_002660	20q12-q13.1
	phospholipase C, gamma 2 (phosphatidylinositol-specific)/PLCG2	600220	NM_002661	16q24.1
	lysosomal acid lipase/LPB	278000	NM_000235	10q24-q25
	lipocortin 1/annexin 1/ANXA1	151690	V00546	9q11-q22
	lipocortin 2/annexin 2/ANXA2	151740	D00017	15q21-q22
	lipocortin 3/annexin 3/ANXA3	106490	M20560	4q21
	lipocortin 5/annexin 5/ANXA4	131230	NM_001154	4q26-q28
	lipocortin 7/annexin 7/ANXA1	186360	NM_004034	10q21.1-q21.2
Phospholipases				
Annexins				



Arachidonate Metabolism	arachidonate 12-lipoxygenase, 12R type/ALOX12B	603741	NM_001139	17pter- p13.1
	arachidonate 15- lipoxygenase/ALOX15	152392	NM_001140	17p13.3
	arachidonate 15-lipoxygenase, second type/ALOX15B	603697	NM_001141	*****
Biosynthesis	prostaglandin endoperoxide synthetase 1/COX1/PTGS1	176805	AH001520	9q32-q33.3
	prostaglandin endoperoxide synthetase 2/COX2/PTGS2			
	thromboxane A synthase 1/TBXAS1	600262	NM_000963	1q25.2-q25.3
	prostaglandin D2 synthase (hematopoietic)	274180	EG_D34613	7q34
	prostaglandin D2 synthase (21kD, brain)/PTGDS	602598	*****	*****
	prostaglandin I2 synthase/prostacyclin synthase/PTGIS	176803	M61900	*****
Prostaglandins	prostaglandin I2 synthase/prostacyclin synthase/PTGIS	601699	EG_D83393	20q13
	prostaglandin E receptor 1, EP1 subtype/PTGER1	176802	NM_000955	19p13.1
	prostaglandin E receptor 2, EP2 subtype/PTGER2	176804	*****	5p13.1
	prostaglandin E receptor 3, EP3 subtype/PTGER3	176806	NM_000957	1p31.2
	prostaglandin E receptor 4, EP4 subtype/PTGER4	601586	NM_000958	5p13.1
	prostaglandin F receptor/PTGFR	600563	L24470	1p31.1
	prostaglandin F2 receptor negative regulator/PTGFRN	601204	U26664	1p13.1-q21.3
Receptors				

Small Molecule Mediators of Inflammation		prostaglandin I2 receptor/PTGIR/prostacyclin receptor	60022	SEG HUMIE	19q13.3
		solute carrier family 21 (prostaglandin transporter), member 2/SLC21A2	601460	NM_005630	3q21
		15-hydroxyprostaglandin dehydrogenase/HPGD	601688	NM_000860	4q34-q35
	Catabolism	aldo-keto reductase family 1, member C2/AKR1C2	600450	NM_001353	10p15-p14
	Biosynthesis	CDP-choline:alkylacetyl glycerol cholinephosphotransferase	*****	*****	*****
	Receptors	platelet activating factor receptor/PTAFR	173393	M88177	1p35-p34.3
	Platelet Activating Factor (PAF)	platelet activating factor acetylhydrolase 1/PAFAH1	601690	NM_00508 4	6p21.2-p12
		platelet activating factor acetylhydrolase, isoform 1B, alpha	601545	NM_00043 0	17p13.3
		platelet activating factor acetylhydrolase, isoform 1B, beta	602508	NM_00257 2	11q23
		platelet activating factor acetylhydrolase, isoform 1B, gamma	603074	NM_00257 3	19q13.1
		platelet activating factor acetylhydrolase 2/PAFAH2	602344	NM_00043 7	*****
		arachidonate 5-lipoxygenase/ALOX5	152390	NM_00069 8	Chr.10
		arachidonate 5-lipoxygenase- activating protein/FLAP/ALOX5AP	603700	NM_00162 9	13q12
	Biosynthesis	arachidonate 12-lipoxygenase, 12R type/ALOX12B	603741	NM_00113 9	17pter- p13.1

Lipoxins		Gamma-glutamyl/transpeptidase 1/GGT1	231950	J04131	22q11.1- q11.2
		Gamma-glutamyl/transpeptidase 1/GGT1	137181	AH002728	22q11.1
		Gamma-glutamyl/transferase-like activity 1/GGTLA1	137168	NM_00412 1	*****
	Receptors	lipoxin A4 receptor	*****	AF054013	*****
	Catabolism	renal microsomal dipeptidase/DPEP1	179780	NM_00441 3	16q24.3
Leukotrienes	Synthesis	arachidonate 5-lipoxygenase/ALOX5	152390	NM_00069 8	Chr.10
		arachidonate 5-lipoxygenase- activating protein/FLAP/ALOX5AP	603700	NM_00162 9	13q12
		leukotriene A4 hydrolase/LTA4H (aminopeptidase)	151570	NM_00089 5	12q22
		leukotriene C4 synthase/LTC4S	246530	NM_00089 7	5q35
		Gamma-glutamyl/transpeptidase 1/GGT1	231950	J04131	22q11.1- q11.2
		Gamma-glutamyl/transpeptidase 1/GGT1	137181	AH002728	22q11.1
		Gamma-glutamyl/transferase-like activity 1/GGTLA1	137168	NM_00412 1	*****
	Receptors	cysteinyl leukotriene receptor 1/CYSLT1	300201	NM_00663 9	Xq13-q21
		leukotriene b4 receptor (chemokine receptor-like 1)/LTB4R	601531	NM_00075 2	14q11.2- q12
	Catabolism	renal microsomal dipeptidase/DPEP1	179780	NM_00441 3	16q24.3
	Biosynthesis	Histidine Decarboxylase	142704	M60445	15q21-q22

Histamine	Receptors	histamine H1 receptor/HRH1	600167	NM_000861	3p21-p14
		histamine H2 receptor/HRH2	142703	AB023486	*****
		histamine H3 receptor/HRH3	*****	NM_007232	*****
		Histamine N-methyltransferase	*****	D16224	chr. 2
	Catabolism	Amine oxidase (copper-containing) 2/AOC2	602268	D88213	17q21
		Amine oxidase (copper-containing) 3/AOC3	603735	AF054985	17q21
	Synthesis	aromatic L-Amino Acid Decarboxylase/AADC	107930	M76180	7p11
		tryptophan hydroxylase/TPH	191060	X52836	11p15.3-p14
		14-3-3 protein ETA	113508	X78138	22q12
		14-3-3 protein ZETA	601288	M86400	2p25.2-p25.1
		14-3-3 protein BETA	601289	X57346	20q13.1
		14-3-3 protein SIGMA	601290	X57348	*****
		serotonin 5-HT receptors 5-HT1A, G protein-coupled	109760	X57829	5q11.2-q13
Serotonin	Receptors	serotonin 5-HT receptors 5-HT1B, G protein-coupled	182131	M81590	6q13
		serotonin 5-HT receptors 5-HT1C, G protein-coupled	312861	U49516	Xq24
		serotonin 5-HT receptors 5-HT1D, G protein-coupled	182133	M81590	1p36.3-p34.3
		serotonin 5-HT receptors 5-HT1E, G protein-coupled	182132	M91467	6q14-q15
		serotonin 5-HT receptors 5-HT1F, G protein-coupled	182134	L05597	3p12

		serotonin 5-HT receptors 5-HT2A, G protein-coupled	182135	D87030	13q14-q21
		serotonin 5-HT receptors 5-HT2B, G protein-coupled	601122	X77307	2q36.3-q37.1
		serotonin 5-HT receptors 5-HT2C, G protein-coupled	312861	U49516	Xq24
		serotonin transporter	182138	X70697	17q11.1-q12
	Catabolism	monoamine oxidase A/ MAOA	309850	M69226	Xp11.23
		monoamine oxidase B MAOB	309860	M69177	Xp11.23
		serotonin N-Acetyltransferase/SNAT	600950	U40347	17q25
		tryptophan 2,3-dioxygenase/TDO2	191070	NM_005651	4q31-q32
Nitric Oxide Pathway	Synthesis	nitric oxide synthetase 1/NOS1	163731	AH001515	12q24.2-q24.31
		nitric oxide synthetase 2A/NOS2A	163730	X85766	17cen-q11.2
		macrophage nitric oxide synthetase 2B/NOS2B	600719	AH006623	17p13.1-q25
		macrophage nitric oxide synthetase 2C/NOS2C	600720	600720	17p13.1-q25
		nitric oxide synthetase 3/NOS3	163729	AH001515	7q36
		chondrocyte nitric oxide synthetase 3/NOS4	163728	X73029	*****
		arginase/ARG1	207800	NM_000045	*****
		arginase/ARG2	107830	NM_0011172	14q24.1-q24.3
		endothelin 1/EDN1	131240	NM_001955	6p24-p23
		endothelin 2/EDN2	131241	NM_001956	1p34
	Synthesis	endothelin 3/EDN3	131242	NM_000114	10q13.2-q13.3

Vascularization	Endothelin	endothelin converting enzyme 1/ECE1	600423	NM_001397	1p36.1
	Receptor	endothelin A receptor isoform delta 3/EDNRA	131243	AF014826	Chr.4
Vascular Endothelial Growth Factor	Synthesis	endothelin receptor type B/EDNRB	131244	NM_000115	13q22
		vascular endothelial growth factor A/VEGFA	192240	M32977	6p12
		vascular endothelial growth factor B/VEGFB	601398	U52819	11q13
		vascular endothelial growth factor C/VEGFC	601528	X94216	*****
		VEGF receptor	191306	X61656	4q12
	Receptor	dopamine beta hydroxylase/DBH	223360	Y00096	9q34
		phenylethanolamine-N-methyltransferase/PNMT	171190	NM_002686	17q21-q22
	Synthesis	tyrosine hydroxylase/TH	191290	X05290	11p15.5
		alpha-1-adrenergic	104219	M76446	Chr.20
	Receptors	alpha-1b-adrenergic	104220	L31773	5q33
		alpha-1c-adrenergic	104221	D25235	8p21
		alpha-1d-adrenergic	104222	M76446	20p13
		alpha-2a-adrenergic	104210	M18415	10q24-q26
		alpha-2b-adrenergic	104260	AF005900	Chr.2
		alpha-2c-adrenergic	104250	J03853	4q16.1
		alpha-2d-adrenergic	109630	J03019	10q24-q26
		beta-1-adrenergic receptor/ADRB1	109690	M15169	5q32-q34
		Beta-2-Adrenergic Receptor/ADRB2	109635	NM_001619	11cen-q13
		beta-adrenergic receptor kinase 1/BARK1	109760	X57829	5q11.2-q13
		Beta-2-Adrenergic Receptor-Like Protein G-21/ADRB2L	109691	X70811	8p12-p11.2
		Beta-3-Adrenergic Receptor/ADRB3			

Epinephrine and Norepinephrine	Beta-Adrenergic Receptor Kinase 1/ADRBK1	109635	X61157	11cen-q13
	Beta-Adrenergic Receptor Kinase 2/ADRBK2	109636	X69117	22q11
Response	phosphodiesterase 4A, cAMP- specific/PDE4A	600126	NM_00620 2	19p13.2
	phosphodiesterase 4B, cAMP- specific/PDE4B	600127	NM_00260 0	1p31
	phosphodiesterase 4C, cAMP- specific/PDE4C	600128	*****	Chr.19
	phosphodiesterase 4D, cAMP- specific/PDE4D	600129	NM_00620 3	5q12
	phosphodiesterase 7A, cAMP- specific/PDE7A	171885	L12052	8q13-q22
	phosphodiesterase 8A, cAMP- specific/PDE8A	602972	AF056490	*****
	phosphodiesterase 9A, cAMP- specific/PDE9A	602973	NM_00260 6	21q22.3
	Vesicular Amine Transporter 2/VAT2	193001	L09118	10q25
	Vesicular Amine Transporter 1/VAT1	193002	*****	8p21.3
Uptake	Solute carrier family 6 , member 5/SLC6A2/NAT1/NET1	163970	NM_00104 3	16q12.2
	Monoamine Oxidase A/MAOA	309850	M69226	Xp11.23
	Monoamine Oxidase B/MAOB	309860	M69177	Xp11.23
Catabolism	Catechol-O-Methyltransferase/COMT	116790	M58525	22q11.2
	Aromatic L-Amino Acid Decarboxylase/AADC/dopa decarboxylase	107930	M76180	7p11
	Tyrosine Hydroxylase	191290	X05290	11p15.5
Biosynthesis				

Dopamine	Receptors	Dopamine Receptor D1	126449	X58987	5q35.1
		Dopamine Receptor D2/DRD2	126450	NM_000795	11q23
		Dopamine Receptor D3/DRD3	126451	U32499	3q13.3
		Dopamine Receptor D4	126452	L12398	11p15.5
		Dopamine Receptor D5	126453	M67439	4p16.1-p15.3
	Reuptake	Dopamine Transporter/ DAT1	126455	L24178	5p15.3
	Catabolism	Dopamine Beta-Hydroxylase/monooxygenase	223360	Y00096	9q34
		Catechol-O-Methyltransferase	116790	M58525	22q11.2
		Monoamine Oxidases A	309850	M69226	Xp11.23
		Monoamine Oxidases B	309860	M69177	Xp11.23
		Phenol Sulfotransferase 1	171150	L10819	16p12.1-p11.2
	Biosynthesis	Phenol Sulfotransferase 2	601292	X78282	16p12.1-p11.2
		Phenol Sulfotransferase 3	600641	L19956	16p11.2
		adenylosuccinate lyase/ADSL	103050	NM_000026	22q13.1
		adenylosuccinate synthetase/ADSS	103060	NM_001126	1cen-q12
		Adenosine A1 Receptor; Adora1/G protein-coupled	102775	L22214	1q32.1
		Adenosine A2 Receptor; Adora2a/G protein-coupled	102776	X68486	22q11.2
		Adenosine A2b Receptor; Adora2b/G protein-coupled	600446	X68487	17p12-p11.2
		Adenosine A3 Receptor; Adora3/G protein-coupled	600445	L20463	1p21-p13



Adenosine	Receptors	Adenosine A2 Receptor-like/ADORA2L1	102777	*****	10q25.3-q26.3
		Purinergic Receptor P2x, Ligand-Gated Ion Channel, 1; P2rx1	600845	NM_002558	*****
		Purinergic Receptor P2x, Ligand-Gated Ion Channel, 3; P2rx3	600843	Y07683	11q12
		Purinergic Receptor P2x, Ligand-Gated Ion Channel, 4; P2rx4	600846	AF000234	12q24.32
		Purinergic Receptor P2x, Ligand-Gated Ion Channel, 5; P2rx5	602836	NM_002561	*****
		Purinergic Receptor P2x, Ligand-Gated Ion Channel, 7; P2rx7	602566	Y09561	12q24
		P2Y11 purinoceptor/G protein-receptor	602697	*****	*****
		P2Y7 purinoceptor/leukotriene B4 receptor/G protein-coupled	601531	NM_000752	14q11.2-q12
		P2Y2 purinoceptor/G protein-coupled	600041	U07225	1q13.5-q14.1
		P2Y1 purinoceptor/G protein-coupled	601167	U42029	3q25
		P2Y4 pyrimidinergic receptor/G protein-coupled	300038	NM_002565	Xq13
		P2Y6 pyrimidinergic receptor/G protein-coupled	602451	NM_004154	11q13.5
	Reuptake	Solute carrier family 29 (nucleosides), member 1/SLC29A1/ENT1	602193	NM_004955	6p21.2-p21.1
		Solute carrier family 29 (nucleosides), member 2/SLC29A2/ENT2	602110	X86681	11q13
	Catabolism	adenosine deaminase	102700	NM_000022	20q13.11
Biosynthesis		Choline acetyltransferase/CHAT	118490	NM_003055	10q11.2
		carnitine acetyltransferase/CRAT	600184	NM_004003	9q34.1
		apolipoprotein E	107741	NM_000041	19q13.2

Neurotransmitter and Peptide Hormone Inflammatory Modulation	Acetylcholine	Receptors	Cholinergic Receptor, Muscarinic, 1; CHRM1	118510	X15263	11q13
			Cholinergic Receptor, Muscarinic, 2; CHRM2	118493	U19800	7q35-q36
			Cholinergic Receptor, Muscarinic, 3; CHRM3	118494	U29589	1q41-q44
			Cholinergic Receptor, Muscarinic, 4; CHRM4	118495	M16405	11p12-p11.2
			Cholinergic Receptor, Muscarinic, 5; CHRM5	118496	AF026263	15q26
			Nicotinic, Cholinergic receptor alpha 1	100690	X70108	2q24-q32
			Nicotinic, Cholinergic receptor alpha 2	118502	U62431	Chr.8
			Nicotinic, Cholinergic receptor alpha 3	118503	X53559	15q24
			Nicotinic, Cholinergic receptor alpha 4	118504	U62433	20q13.2-q13.3
			Nicotinic, Cholinergic receptor alpha 5	118505	M83712	15q24
			Nicotinic, Cholinergic receptor alpha 7/CHRNA7	118511	U40583	15q14
			Nicotinic, Cholinergic receptor beta 1	100710	X14830	17p12-p11
			Nicotinic, Cholinergic receptor beta 2	118507	Y08415	1p21
			Nicotinic, Cholinergic receptor beta 3	118508	X67513	8p11.2
			Nicotinic, Cholinergic receptor beta 4	118509	X68275	15q24
			Nicotinic, Cholinergic receptor epsilon polypeptide	100725	X66403	Chr.17
			Nicotinic, Cholinergic receptor,	100720	X55019	2q33-q34
			Nicotinic, Cholinergic receptor,	100730	NM_005199	2q33-q34
			Reuptake Vesicular acetylcholine transporter	600336	NM_003055	10q11.2
			Catabolism Acetylcholinesterase/ACHE	100740	M55040	7q22
			butyrylcholinesterase 1/serum cholinesterase 1/BCHE1	177400	NM_000055	3q26.1-q26.2

	butyrylcholinesterase 2/serum cholinesterase 2/BCHE2	177500	*****	2q33-q35
	voltage-dependent calcium channel, P/Q type, alpha 1A	141500	NM_000068	19p13
	calcium channel, voltage-dependent, L type, alpha 1B subunit/CACNA1B	601012	NM_000718	9q34
	calcium channel, voltage-dependent, L type, alpha 1C subunit/CACNA1C	114205	NM_000719	12p13.3
	calcium channel, voltage-dependent, L type, alpha 1D subunit/CACNA1D	114206	NM_000720	3p14.3
Calcium Channels	L-type voltage dependent calcium channel alpha 1S subunit/CACNA1S	114208	NM_000069	1q32
	calcium channel, voltage-dependent, beta 1 subunit/CACNB1	114207	NM_000723	17q21-q22
	voltage dependent calcium channel beta 2 subunit/CACNB2	600003	U07139	10p12
	calcium channel, voltage-dependent, alpha 2/delta subunit/CACNA2D1	114204	Z28613	7q21-q22
	calcium channel, voltage-dependent, gamma subunit/CACNG	114209	NM_000727	17q24
	neuronal voltage dependent calcium channel gamma subunit/CACNG2	602911	NM_006078	*****
	sodium channel, nonvoltage-gated 1, beta (Liddle syndrome)/SCNN1B	600760	NM_000336	16p13-p12
	sodium channel, nonvoltage-gated 1, gamma/SCNN1G	600761	NM_001039	16p13-p12
	cyclic nucleotide gated hyperpolarization activated potassium	602780	AF064876	*****
Sodium Channels				
Channels				

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Potassium Channels	cyclic nucleotide gated hyperpolarization activated potassium	602781	AF064877	*****
	potassium inwardly-rectifying channel, subfamily J, member 2 (KCNJ2)	600681	NM_000891	Chr. 17
	voltage dependent potassium channel, subfamily K, member 2/KCNK2	603219	*****	1q41
	G protein coupled potassium channel, subfamily J, member	601534	NM_002239	2q24.1
	G protein coupled potassium channel inward rectifier/GIRK3	600932	*****	1q21-q23
	voltage dependent potassium channel, subfamily S, member 3/KCNK3	603888	AF043472	2p24
	potassium voltage-gated channel precursor, KQT-like subfamily, member 1/KCNQ1	192500	NM_000218	11p15.5
	potassium intermediate/small conductance calcium-activated channel, subfamily N, member	602754	NM_002250	19q13.2
	chloride channel, calcium activated, family member 1/CLCA1	603906	NM_001285	1p31-p22
	chloride channel, calcium activated, family member 2/CLCA2	604003	NM_006536	*****
Chloride	cystic fibrosis transmembrane conductance regulator/CFTR	602421	NM_000492	7q31.2
	membrane metalloendopeptidase/MME/neutral endopeptidase	120520	AH002677	3q21-q27
	proopiomelanocortin	176830	NM_000939	2p23.3

Opioids	Biosynthesis	prepronociceptin/nociceptin/nosistatin/ PNO	601459	*****	8p21
		preproenkephalin			
		B/prodynorphin/PDYN	131340	NM_006211	20pter-p12.21
		preproenkephalin			
		A/proenkephalin/PENK	131330	NM_006211	8q23-q24
	Receptors	Opioid Receptor, Mu-1; Oprm1	600018	NM_000914	6q24-q25
		Opioid Receptor, Kappa-1; Oprk1	165196	U17298	8q11.2
		opioid.receptor-like 1/OPRL 1	602548	X77130	*****
		Opioid Receptor, Delta-1; Oprd1	165195	U10504	1p36.1-p34.3
		Opioid Receptor, Sigma 1	601978	U75283	*****
		opioid binding cell adhesion molecule/OBCAM	600632	*****	Chr.11
		G protein-coupled receptor 7/GPR7	600730	U22491	0q11.2-q21.1
		G protein-coupled receptor 8/GPR8	600731	U22492	20q13.3
Leptin	Biosynthesis	leptin/LEP	164160	NM_000230	7q31.3
	Receptor	leptin receptor/LEPR	601007	NM_002303	1p31
	Biosynthesis	Cholecystokinin/CCK	118440	L00354	3pter-p21
	Receptors	Cholecystokinin A receptor/CCKAR	118444	L13605	4p15.2-p15.1
		Cholecystokinin B receptor/CCKBR	118445	L08112	1p15.5-p15.4
		Neurokinin A/Tachykinin 1 or 2/Substance P or K	162320	U37529	7q21-q22
	Biosynthesis	Neurokinin B/Tachykinin 3	162330	*****	12q13-q21
	Receptors	Tachykinin NK1 receptor/TACR1	162323	M81797	Chr.2
		Tachykinin NK2 receptor/TACR2	162321	M57414	10q11-q21
		Tachykinin NK3 receptor/TACR3	162332	M89473	*****
	Biosynthesis	kininogen/KNG	228960	*****	3q27
		kallikrein 1/KLK1	147910	AH002853	9q13.2-q13.4

Bradykinin	Receptor	bradykinin receptor B1/BDKRB1 G	600337	NM_000710	4q32.1-q32.2
		protein-coupled			
		bradykinin receptor B2/BDKRB2 G	113503	NM_000623	4q32.1-q32.2
		protein-coupled			
Parathyroid Hormone (PTH)	Biosynthesis	parathyroid hormone-related protein/parathyroid hormone-like hormone/PTH LH	168470	NM_002820	12p12.1-p11.2
		parathyroid hormone/PTH	168450	NM_000315	1p15.3-p15.1
		parathyroid hormone receptor	168468	NM_000316	3p22-p21.1
		parathyroid hormone receptor	601469	NM_005048	2q33
ACTH	Receptors	proopiomelanocortin	176830	NM_000939	2p23.3
		melanocortin 1 receptor (alpha melanocyte stimulating hormone receptor)/MC1R	155555	NM_002386	16q24.3
	Receptor	melanocortin 2 receptor/ACTH receptor/MC2R	202200	NM_000529	18p11.2
		melanocortin 4 receptor/MC4R	155541	NM_005912	18q22
		melanocortin 5 receptor/MC5R	600042	NM_005913	18p11.2
		Folate Receptor Alpha/FOLR1	136430	M28099	1q13.3-q13.5
	Receptors	Folate Receptor Beta/FOLR2	136425	AF000380	1q13.3-q13.5
		Folate Receptor Gamma/FOLR3	602469	Z32564	*****
	Transporter	Folate Transporter (SLC19A1)	600424	U19720	21q22.3
		Vitamin B12 binding protein	275350	NM_000355	22q11.2-qter
	Glutaminat ion	folylpolyglutamate synthetase/PPGS	136510	M98045	9cen-q34
		gamma-glutamyl hydrolase/GGGH	601509	U55206	*****
		Methylenetetrahydrofolate reductase/MTHFR	236250	U09806	1p36.3
		Dihydrofolate reductase/DHFR	126060	J00140	5q11.2-q13.2

Folate Metabolism	5,10-methylenetetrahydrofolate dehydrogenase, 5,10- methylenetetrahydrofolate cyclohydrolase, 10- formyltetrahydrofolate synthetase/MTHFD1	172460	NM_005956	14q24
	5,10-methylenetetrahydrofolate synthetase (5-formyltetrahydrofolate cyclo-ligase)/MTHFS	604197	NM_006441	Chr. 15
	phosphoribosylglycinamide formyltransferase, phosphoribosylglycinamide synthetase,			
	phosphoribosylaminoimidazole folate hydrolase 1/FOH1	138440	NM_000819	21q22.1
	6-pyruvoyl tetrahydrobiopterin synthase/PTPS	600934	NP_004467	11q14
	serine hydroxymethyltransferase 1 (soluble)/SHMT1	261640	Q03393	1q22.3-q23.3
	serine hydroxymethyltransferase 2 (mitochondrial)/SHMT2	182144	NM_004169	17p11.2
	Glycine aminotransferase/glycine cleavage T protein/GAT	138450	NM_005412	12q13
	5-methyltetrahydrofolate- homocysteine methyltransferase/methionine glutamate	238310	NM_000481	3p21.2-p21.1
	formiminotransferase/dihydrofolate synthetase	156570	NM_000254	1q43
		229100	*****	*****

## Metabolism

General Cell Growth	Purine Metabolism	Purine Metabolism	hypoxanthine-guanine phosphoribosyltransferase	308000	M31642	Xq26-q27.2
			adenosine phosphoribosyltransferase/APRT	102600	NM_000485	16q24
			thiopurine S-methyltransferase/TPMT	187680	NM_000367	6p22.3
			IMP (inosine monophosphate) dehydrogenase 1/IMPDH1	146690	NM_000883	7q31.3-q32
			IMP (inosine monophosphate) dehydrogenase 2/IMPDH2	146691	NM_000884	3p21.2
			adenylosuccinate synthetase/ADSS	103060	NM_001126	1cen-q12
			adenylosuccinate lyase	103050	NM_000026	22q13.1
			glycinamide ribotide formyltransferase	138440	X54199	21q22.1
			urate oxidase	191540	AH003594	1p22
			purine nucleoside phosphorylase	164050	NM_000270	14q13.1
			xanthine oxidase	278300	NM_000379	2p23-p22
			adenosine deaminase	102700	NM_000022	20q13.11
	Cytoskeleton	Tubulin	beta tubulin/TUBB	191130	NM_001069	6p21.3
			beta tubulin 2/TUBB2	602660	NM_006088	*****
			beta tubulin 4/TUBB4	602661	NM_006086	*****
			beta tubulin 5/TUBB5	602662	NM_006087	*****



[illegible]

### Table 5. Metabolism and Endocrinology Gene List

Table 5. Meatbolism and Endocrinology Gene List						
Class	Pathway	Function	Name	OMIM	GID	Locus
			membrane			
			metalloendopeptidase/neutral	120520	NM_000902	3q21-q27
			calpain, large polypeptide L3/CAPN3	114240	NM_000070	5q15.1-q21.1
			leucyl/cystinyl	151300	NM_005575	*****
			carboxypeptidase N polypeptide			
			1/CPN1	603103	NM_001308	chr. 10

General Metabolism for Peptide Hormones	Peptide Hormone Processing	Proteases and Protease Inhibitors	carboxypeptidase N polypeptide 2/regulatory subunit/CPN2	603104	J05158	8p23-p22
			meprin alpha subunit/MEP1A	600388	NM_005925	6p21.2-p21.1
			carboxypeptidase E/CPE	114855	NM_001873	Chr.4
			tubby (mouse) homolog/TUB	601197	NM_003320	11p15.5
			meprin beta subunit/MEP1B	600389	NM_005925	8q12.2-q12.3
			prolyl endopeptidase/PREP	600400	NM_002726	6q22
			neuroendocrine convertase 1/NEC1/proprotein convertase			
			subtilisin/kexin type 1/PCSK1	162150	NM_000439	5q14-q21
			peptidylglycine alpha-amidating monooxygenase/PAM/NEC2	170270	NM_000919	5q14-q21
			paired basic amino acid cleaving enzyme/PACE/FUR	136950	NM_002569	15q25-q26
Circadian Regulation	Melatonin		serotonin N-Acetyltransferase/SNAT	600950	U40347	17q25
			X-chromosomal acetylserotonin N-methyltransferase/ASMT	300015	NM_004043	Xpter-p22.32
			Y-chromosomal acetylserotonin N-methyltransferase/ASMT	402500	*****	Ypter-p11.2
			acetylserotonin N-methyltransferase-like/ASMTL	300162	NM_004192	Xpter-p22.32
			melatonin receptor 1A/MTNR1A	600665	NM_005958	4q35.1
			melatonin receptor 1B/MTNR1B	600804	NM_005959	11q21-q22
			tryptophan 2,3-dioxygenase/TDO2	191070	NM_005651	4q31-q32
			corticotropin releasing hormone/CRH	122560	NM_000756	8q13
			urocortin/UCN	600945	NM_003353	Chr.2
			urocortin 2/UCN2	604097	AF104118	*****
	CRH		Corticotropin releasing hormone receptor 1/CRHR1	122561	U16273	17q12-q22

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Adrenocorticotrophic Hormone	Corticotropin releasing hormone receptor 2/CRHR2	602034	NM_001883	7p21-p15
	Corticotropin releasing hormone-binding protein/CRHBP	122559	NM_001882	5q11.2-q13.3
ACTH	proopiomelanocortin/POMC	176830	NM_000939	2p23.3
	melanocortin 2 receptor/ACTH receptor/MC2R	202200	NM_000529	18p11.2
TRH	thyrotropin releasing hormone/TRH	275120	NM_007117	3p
	thyrotropin releasing hormone receptor/G protein coupled/TRHR	188545	NM_003301	8q23
TSH	cAMP responsive element binding protein 1/CREB1	123810	NM_004379	2q32.3-q34
	chorionic gonadotropin alpha chain/TSHA/CGA	118850	NM_000735	6q21.1-q23
	thyroid stimulating hormone beta chain/TSHB	188540	NM_000549	1p13
	thyroid stimulating hormone receptor/TSHR	603372	NM_000369	14q31
	solute carrier family 5 (sodium iodide symporter), member 5/SLC5A5	601843	NM_000453	19p13.2-p12
Thyroid Hormone	thyroid peroxidase (nuclear gene encoding mitochondrial protein)/TPO	274500	NM_000547	2p25
	thyroglobulin/TG	188450	NM_003235	8q24.2-q24.3
	thyroxine-binding globulin/TBG	314200	NM_000354	Xq22.2
	transthyretin (prealbumin, amyloidosis type I)/TTR	176300	NM_000371	18q11.2-q12.1

Peptide Hormones Control of Metabolism	Thyroid Hormone Synthesis	deiodinase, iodothyronine, type I/DIO1	147892	NM_00079 2	1p33-p32
		deiodinase, iodothyronine, type II/DIO2	601413	NM_00079 3	14q24.2- q24.3
		thyroid hormone receptor, alpha (avian erythroblastic leukemia viral (v-erb-a) oncogene homolog)/THRA	190120	NM_00325 0	17q11.2
		thyroid hormone receptor, alpha (avian erythroblastic leukemia viral (v-erb-a) oncogene homolog 2)/THRB	190160	S57224	3p24.3
		thyroid hormone receptor coactivating protein/SMAP	601836	NM_00669 6	*****
		silencing mediator for retinoid and thyroid hormone receptors/SMRT	600848	NM_006312	*****
		retinoic and thyroid hormone receptor associated corepressor 1/TRAC1/NCOR1	600849	NM_006311	*****
		deiodinase, iodothyronine, type III/DIO3	601038	NM_00136 2	14q32
	GNRH (common to all gonadotropin s except CGH)	gonadotropin releasing hormone 1/LHRH/GNRH1	152760	NM_000825	8p21-p11.2
		gonadotropin releasing hormone 2/LHRH/GNRH2	602352	NM_001501	20p13
		gonadotropin releasing hormone receptor/G protein- coupled/LHRHR/GNRHR	138850	NM_000406	4q21.2
		prolactin/PRL	176760	NM_000948	6p22.2-p21.3
		prolactin receptor/PRLR	176761	NM_000949	5p13-p12
	Prolactin				

<b>Leuteinizing Hormone</b>	cAMP responsive element binding protein 1/CREB1	123810	NM_004379	2q32.3-q34
	glycoprotein hormones, alpha polypeptide/CGAa	118850	NM_000735	6q21.1-q23
	leuteinizing hormone beta polypeptide/LHB	152780	NM_000894	19q13.32
	leuteinizing hormone/choriogonadotropin	152790	NM_000233	2p21
	glycoprotein hormones, alpha polypeptide/CGAa	118850	NM_000735	6q21.1-q23
<b>Gonadotropin c Hormones</b>	follicle stimulating hormone-inhibin, beta A (activin A, activin AB alpha polypeptide)/INHBA	136530	AH002701	11p13
	activin A receptor, type I/ACVR1	147290	NM_002192	7p15-p13
	activin A receptor, type IB/ACVR1B	102576	NM_001105	2q23-q24
	activin A receptor type II-like 1/ACVRL1	601300	NM_004302	12q13
	activin type II A receptor/ACVR2	601284	NM_000020	12q11-q14
	activin A receptor, type IIB/ACVR2B	102581	NM_001616	*****
	alpha-inhibin/INHBA	602730	NM_001106	3p22-p21.3
	beta-B inhibin/beta C inhibin/INHBC	147380	NM_001106	2q33-q36
	folliculin/FST	601233	NM_005538	12q13.1
	follicle stimulating hormone receptor/FSHR	136470	NM_006350	5p14
	FSH primary response (LRPR1, rat) homolog 1/FSHPRH1	136435	NM_000145	2p21-p16
	glycoprotein hormones, alpha polypeptide/CGAa	300065	NM_006733	Xq22
<b>Gonadotropin c Hormones</b>	glycoprotein hormones, alpha polypeptide/CGAa	118850	NM_000735	6q21.1-q23

Chorionic Gonadotropin	chorionic gonadotropin, beta polypeptide/CGB	118860	NM_000737	19q13.32
	luteinizing hormone/choriogonadotropin	152790	NM_000233	2p21
Anabolism	3-hyd oxy-3-methylglutaryl-Coenzyme A synthase 1	142940	NM_002130	5p14-p13
	HMGCoA reductase/HMGCR	142910	NM_000859	5q13.3-q14
	squalene synthetase/arnesyl-diphosphate farnesyltransferase	184420	NM_004462	8p23.1-p22
	steroid-5-alpha-reductase, alpha polypeptide 1 (3-oxo-5 alpha-steroid delta 4-dehydrogenase alpha 1)/SRD5A1	184753	NM_001047	5p15
	steroid-5-alpha-reductase, alpha polypeptide 2 (3-oxo-5 alpha-steroid delta 4-dehydrogenase alpha 2)/SRD5A2	264600	NM_000348	2p23
	steroidogenic acute regulatory protein/STAR	600617	NM_000349	8p11.2
	cytochrome P450, subfamily XIA (cholesterol side chain cleavage)/CYP11A	118485	NM_000781	15q23-q24
	ferredoxin 1/FDX1	103260	NM_004109	11q22
	cytochrome P450, subfamily XVII (steroid 17-alpha-hydroxylase), adrenal hyperplasia/CYP17	202110	NM_000102	10q24.3
	General Steroid Hormone Metabolism			

(additional genes in Toxicology)		hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 1/HSD3B1	109715	NM_000862	1p13.1
		hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 2/HSD3B2	201810	NM_000198	1p13.1
Catabolism		dehydroepiandrosterone (DHEA)-preferring sulfotransferase, family 2A, member 1/SULT2A1	125263	NM_003167	19q13.3
		estrogen-preferring	600043	NM_005420	4q13.1
		UDP glycosyltransferase 1/UGT1	191740	NM_001072	Chr. 12
		UDP glycosyltransferase family 2, member B4/UGT2B4	600067	NM_001073	4q13
		UDP glycosyltransferase family 2, member B7/UGT2B7	600068	NM_001074	1q14
		UDP glycosyltransferase 2 family, polypeptide B11/UGT2B11	603064	NM_001073	*****
		UDP glycosyltransferase family 2, member B15/UGT2B15	600069	NM_001076	4q13
		UDP glycosyltransferase family 2, member B17/UGT2B17	601903	NM_001077	1q14
		hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 1/HSD3B1	109715	NM_000862	1p13.1
		hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 2/HSD3B2	201810	NM_000198	1p13.1
Synthesis					

Progestins	Receptors	progesterone receptor/PGR	264080	NM_000926	11q22
		heat shock 90-kD protein 1, alpha subunit/HSPCA	140571	*****	1q21.2-q22
		heat shock 90-kD protein 1, beta subunit/HSPCB	140572	J04988	6p12
		FK506-binding protein 5/FKBP5	602623	NM_004117	*****
Estrogens	Synthesis	cytochrome P450, subfamily XIX (arogen aromatase)/CYP19	107910	NM_000103	15q21.1
		estrogen receptor 1/ESR1	133430	NM_000125	6q25.1
	Receptors	estrogen receptor 2/ESR2	601663	X99101	14q
		estrogen-related receptor	601998	NM_004451	11q12
Androgens		estrogen-related receptor beta/ESRRB	602167	NM_004452	14q24.3
	Catabolism	estrogen-preferring	600043	NM_005420	4q13.1
		steroid-5-alpha-reductase, alpha polypeptide 1 (3-oxo-5 alpha-steroid delta 4-dehydrogenase alpha 1)/SRD5A1	184753	NM_001047	5p15
	Synthesis	hydroxysteroid (17-beta) dehydrogenase 3/HSD17B3	264300	NM_000197	9q22
Receptor		cytochrome P450, subfamily XIA (cholesterol side chain cleavage)/CYP11A	118485	NM_0000781	15q23-q24
		steroid 5-alpha-reductase 2/SRD5A2	264600	NM_000348	2p23
		androgen receptor			
		(dihydrotestosterone receptor)/AR	313700	NM_000044	Xq11-q12
Catabolism		UDP glycosyltransferase 2 family, polypeptide B17/UGT2B17	601903	NM_001077	4q13



Glucocorticoids (cortisol, corticosterone)	Synthesis	cytochrome P450, subfamily XXI (steroid 21-hydroxylase)/CYP21	201910	X58902	6p21.3
		cytochrome P450, subfamily XIB (steroid 18-beta-hydroxylase), polypeptide 2/CYP11B2	124080	NM_000498	8q21
Receptor and Cofactors		cytochrome P450, subfamily XIB (steroid 11-beta-hydroxylase), polypeptide 1/CYP11B1	202010	NM_000497	8q21
		glucocorticoid receptor/GRL	138040	NM_000176	5q31
		heat shock 70kD protein 1/HSPA1A	140550	NM_005345	6p21.3
		heat shock 70kD protein-like 1/HSPA1L	140559	NM_005527	6p21.3
		heat shock 70kD protein 1/HSPA1B	603012	NM_005346	6p21.3
		heat shock 90-kD protein 1, alpha subunit/HSPCA	140571	*****	1q21.2-q22
		heat shock 90-kD protein 1, beta subunit/HSPCB	140572	J04988	6p12
		FK506-binding protein 4 (59kD)/FKBP4	600611	NM_002014	*****
		mineralocorticoid receptor/MCR/nuclear receptor subfamily 3, group C, member	600983	NM_000901	4q31.1
		corticosteroid binding globulin precursor/CBG	122500	NM_001756	14q32.1
Transport and Catabolism		hydroxy-D-5-steroid dehydrogenase, 3 b- and steroid D-isomerase 2/HSD3B2	201810	NM_000198	1p13.1
		cytochrome P450, subfamily XIB, polypeptide 2 (steroid 11-b- hydroxylase)/CYP11B2	124080	NM_000498	8q21

Mineralocorticosteroids (aldosterone, deoxycorticosterone)	Synthesis	sodium channel, nonvoltage-gated 1 alpha/SCNN1A	600228	NM_001038	12p13
		sodium channel, nonvoltage-gated 1, beta (Liddle syndrome)/SCNN1B	600760	NM_000336	16p13-p12
		sodium channel, nonvoltage-gated 1, gamma/SCNN1G	600761	NM_001039	16p13-p12
	Receptor	mineralocorticoid receptor/MCR/nuclear receptor subfamily 3, group C, member	600983	NM_000901	4q31.1
Mediators of Steroid Response	Transcription Factors	nuclear receptor coactivator 2/GRIP1	601993	NM_006540	*****
		oxysterol binding protein/OSBP	167040	NM_002556	11q12-q13
		sterol regulatory element binding transcription factor 1/SREBF1	184756	NM_004176	17p11.2
		sterol regulatory element binding transcription factor 2/SREBF2	600481	NM_004599	22q13
		steroid receptor coactivator 1/SRC1	602691	NM_003743	2p23
		steroid receptor RNA activator/SRA	603819	AF092038	Chr. 5
Serotonin	Receptors	5-hydroxytryptamine (serotonin) receptor 2C (G protein- coupled)/HTR2C	312861	NM_000868	Xq24
	Receptors	dopamine receptor D1/DRD1	126449	NM_000794	5q35.1
Dopamine	Receptors	dopamine receptor D2/DRD2	126450	NM_000795	11q23
	Receptors	adrenergic, beta-2-, receptor, surface/ADRB2	109690	NM_000024	5q32-q34
Norepinephrine	Receptors	adrenergic, beta-3-, receptor/ADRB3	109691	NM_000025	8p12-p11.2
	Biosynthesis	Neuropeptide Y/NPY	162640	NM_000905	7p15.1
Neurotransmitters		Neuropeptide Y receptor Y1/NPY1R	162641	NM_000909	4q31.3-q32
		Neuropeptide Y receptor Y2/NPY2R	162642	NM_000910	4q31

Neuropeptide Y (NPY)	Receptors	Neuropeptide Y receptor Y3/chemokine receptor	162643	X71635	2q21
		Neuropeptide Y receptor Y5/NPY5R	602001	NM_006174	4q31-q32
		Neuropeptide Y receptor Y6/NPY6R	601770	NM_006173	5q31
Galanin	Biosynthesis	preprogalanin/GAL1	137035	L11144	1q13.3-q13.5
	Receptor	galanin receptor 1 (brain)/GALR1	600377	NM_001480	18q23
		galanin receptor 2/GALR2	603691	NM_003857	17q25.3
Pro-Melanin Concentrating Hormone		galanin receptor 3 (brain)/GALR3	603692	NM_003614	2q12.2-q13.1
	Biosynthesis	pro-melanin-concentrating hormone/PMCH	176795	NM_002674	12q23-q24
		pro-melanin-concentrating hormone-like 1/PMCHL1	176793	*****	5p14
		pro-melanin-concentrating hormone-like 2/PMCHL2	176794	AF064698	5q12-q13
		melanin-concentrating hormone receptor/MCHR/G protein-coupled receptor 24/GPR24	601751	NM_005297	22q13.3
	Receptors	proopiomelanocortin/POMC	176830	NM_000939	2p23.3
Melanocortin	Biosynthesis	melanocortin 1 receptor (alpha melanocyte stimulating hormone receptor)/MC1R	155555	NM_002386	16q24.3
	Receptors	melanocortin 4 receptor/MC4R	155541	NM_005912	18q22
		melanocortin 5 receptor/MC5R	600042	NM_005913	18p11.2
		agouti (mouse)-signaling protein/ASIP	600201	NM_001672	20q11.2
	Regulation	cAMP responsive element binding protein 1/CREB1	123810	NM_004379	2q32.3-q34

Peptide Hormonal Regulation of Appetite	Opioids	Biosynthesis	preproenkephalin B/prodynorphin/PDYN	131340	NM_006211	12pter-p12.21
		Receptors	preproenkephalin A/proenkephalin/PENK	131330	NM_006211	8q23-q24
	Cholecystokinin (CCK)	Biosynthesis	opioid receptor, kappa 1/OPRK1	165196	NM_000912	8q11.2
		Receptors	Cholecystokinin/CCK	118440	NM_000729	3pter-p21
	Adrenocorticotropic Hormone	Biosynthesis	Cholecystokinin A receptor/CCKAR	118444	NM_000730	4p15.2-p15.1
		Receptors	Cholecystokinin B receptor/CCKBR	118445	NM_000731	1p15.5-p15.4
		Biosynthesis	corticotropin releasing hormone/CRH	122560	NM_000756	8q13
			urocortin/UCN	600945	NM_003353	Chr.2
			urocortin 2/UCN2	604097	AF104118	*****
		Receptors	Corticotropin releasing hormone receptor 1/CRHR1	122561	U16273	17q12-q22
		Signalling	Corticotropin releasing hormone receptor 2/CRHR2	602034	NM_001883	7p21-p15
			Corticotropin releasing hormone-binding protein/CRHBP	122559	NM_001882	5q11.2-q13.3
	PACAP	Biosynthesis	adenylate cyclase activating polypeptide 1 (pituitary)/ADCYAP1	102980	NM_001117	18p11
		Receptor	adenylate cyclase activating polypeptide 1 (pituitary) receptor type I/ADCYAP1R1	102981	NM_001118	7p14
	Enterostatin	Biosynthesis	enterostatin/colipase, pancreatic/CLPS	120105	NM_001832	6pter-p21.1
		Biosynthesis	insulin/INS	176730	NM_000207	11p15.5
	Insulin	Receptor	insulin receptor/INSR	147670	NM_000208	19p13.2
			leptin/LEP	164160	NM_000230	7q31.3
		Biosynthesis	peroxisome proliferative activated receptor, gamma/PPARG	601487	NM_005037	3p25

Leptin	Signalling	Receptor	leptin receptor/LEPR	601007	NM_002303	1p31
			signal transducer and activator of transcription 3/STAT3	102582	NM_003150	17q21
			signal transducer and activator of transcription 5A/STAT5A	601511	NM_003152	17q11.2
			signal transducer and activator of transcription 6, interleukin-4 induced/STAT6	601512	NM_003153	12q13
Thyroid Hormone	Biosynthesis		thyrotropin releasing hormone/TRH	275120	NM_007117	3p
		Receptors	thyrotropin releasing hormone receptor/G protein coupled/TRHR	188545	NM_003301	8q23
Glucagon	Biosynthesis		paired box gene 6/PAX6	106210	NM_000280	11p13
			preproglucagon/GCG	138030	NM_002054	2q36-q37
	Receptor		glucagon receptor/GCGR	138033	NM_000160	17q25
			glucagon-like peptide 1	138032	NM_002062	6p21
Glucagon-Like Polypeptides	Biosynthesis		glucagon-like peptide 2	603659	NM_004246	17p13.3
			paired box gene 6/PAX6	106210	NM_000280	11p13
	Receptors		preproglucagon/GCG	138030	NM_002054	2q36-q37
			glucagon-like peptide 1	138032	NM_002062	6p21
			glucagon-like peptide-2 receptor precursor/GLP2R	603659	AF105367	17p13.3
			somatostatin transcription factor 1/STF1/homeodomain transcription factor/insulin promoter factor 1/IPF1	600733	NM_000209	13q12.1
			paired box gene 6/PAX6	106210	NM_000280	11p13
			paired box gene 4/PAX4	167413	NM_006193	7q32

Control of Metabolism	Insulin	Homo sapiens paired box gene	167415	NM_003466	2q12-q14
		insulin/INS	176730	NM_000207	11p15.5
Biosynthesis	Insulin	neurogenic differentiation	601724	NM_002500	2q32
		cAMP responsive element binding protein 1/CREB1	123810	NM_004379	2q32.3-q34
		lim homeobox transcription factor 1, alpha/LIMX1A	600298	*****	1q22-q23
		caudal type homeo box transcription factor 2/CDX2	600297	NM_001265	13q12.3
		purine-rich element binding protein A/PURA	600473	NM_005859	5q31
		ATP-binding cassette, sub-family C, member 8/ABCC8/sulfonylurea receptor (hyperinsulinemia)/SUR1	600509	NM_000352	11p15.1
		ATP-binding cassette, sub-family C (C beta-cell inward rectifier subunit/BIR/potassium inwardly-rectifying channel, subfamily J, member 11/KCNJ11	601439	NM_005691	12p12.1
		carboxypeptidase E/CPE	114855	NM_001873	Chr.4
		insulin receptor/INSR	147670	NM_000208	19p13.2
		insulin receptor substrate 1/IRS1	147545	NM_005544	2q36
		insulin receptor substrate 2/IRS2	600797	NM_003749	13q34
		insulin receptor substrate 4/IRS4	603510	NM_003604	*****
		growth factor receptor-bound protein 10/GRB10	601523	NM_005311	7p12-p11.2
		Receptor			

		growth factor receptor-bound protein 2/GRB2	108355	NM_002086	17q24-q25
	Signaling	amylin/diabetes-associated peptide/DAP/islet amyloid polypeptide/IAPP	147940	NM_000415	12p12.3-p12.1
	Metabolism	insulin-degrading enzyme/IDE	146680	NM_004969	10q23-q25
		uncoupling protein 1 (mitochondrial, proton carrier)/UCP1	113730	X51953	4q31
	Uncoupling Proteins	uncoupling protein 2 (mitochondrial, proton carrier)/UCP2	601693	AF019409	11q13
		uncoupling protein 3 (mitochondrial, proton carrier)/UCP3	602044	NM_003356	11q13
		uncoupling protein 4 (mitochondrial, proton carrier)/UCP4	*****	NM_004277	*****
		somatostatin transcription factor 1/STF1/homeodomain transcription factor/insulin promoter factor 1/IPF1	600733	NM_000209	13q12.1
	Biosynthesis	paired box gene 6/PAX6	106210	NM_000280	11p13
		cAMP responsive element binding protein 1/CREB1	123810	NM_004379	2q32.3-q34
		somatostatin/SST	182450	NM_001048	3q28
	Somatostatin	preprocartistatin/CORT	602784	NM_001302	1p36
		Somatostatin receptor 1/G protein-coupled/SSSTR1	182451	NM_001049	14q13
		Somatostatin receptor 2/SSSTR2	182452	NM_001050	17q24
		Somatostatin receptor 3/adenyl cyclase coupled/SSSTR3	182453	NM_001051	22q13.1
		Somatostatin receptor 4/SSSTR4	182454	NM_001052	20p11.2

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<b>Growth Hormone</b>	<b>GHRH</b>	Somatostatin receptor 5/SSTR5 growth hormone releasing hormone/GHRH	182455	NM_001053	16p13.3
		growth hormone releasing hormone receptor/G protein-coupled/GHRHR	139190	AH002712	20q11.2
		growth hormone releasing hormone receptor/G protein-coupled/GHRHR	139191	NM_000823	7p15-p14
	<b>Growth Hormone</b>	growth hormone 1/somatotropin/GH1	139250	NM_000515	17q22-q24
<b>Biosynthesis</b>		growth hormone receptor/GHR	600946	NM_000163	5p13-p12
		insulin-like growth factor 1 (somatomedin C)/IGF1	147440	M27544	12q22-q24.1
		insulin-like growth factor 2 (somatomedin A)/IGF2	147470	NM_000612	11p15.5
	<b>Receptor</b>	insulin-like growth factor 1 receptor precursor/IGF1R	147370	NM_000875	15q25-q26
<b>Insulin-Like Growth Factor</b>		insulin-like growth factor 2 receptor/IGF2R	147280	NM_000876	6q26
		insulin-like growth factor binding protein	146730	NM_000596	7p14-p12
		insulin-like growth factor binding protein	146731	M35410	2q33-q34
		insulin-like growth factor binding protein	146732	NM_000598	7p14-p12
		insulin-like growth factor binding protein	146733	Y12508	17q12-q21
		insulin-like growth factor binding protein	146734	AF055033	2q33-q36
		insulin-like growth factor binding protein	146735	M69054	12q13
		insulin-like growth factor binding protein	602867	NM_001553	4q12
		connective tissue growth factor/CTGF	121009	NM_001901	6q23.1
		insulin-like growth factor binding protein	602369	NM_001554	1p22.3
		insulin-like growth factor binding protein	601489	NM_004970	Chr. 16
	<b>Catabolism</b>	protease, serine, 11 (IGF binding)/PRSS11	602194	NM_002775	0q25.3-q26.2
		heparin-binding growth factor 1/FGF1	131220	NM_000800	5q31
		basic fibroblast growth factor/FGF2	134920	NM_002006	4q25-q27



Fibroblast Growth Factor	Biosynthesis			
	fibroblast growth factor 3/FGF3	164950	NM_005247	11q13
	HST oncogene/fibroblast growth factor 4/FGF4	164980	NM_002008	11q13
	fibroblast growth factor-related protein/FGF5	165190	NM_004464	4q21
	fibroblast growth factor 6/FGF6	134921	X57075	12p13
	keratinocyte growth factor/fibroblast growth factor 7/FGF7	148180	NM_002009	15q15-q21.1
	fibroblast growth factor 8 (androgen-induced)/FGF8	600483	NM_006119	10q24
	fibroblast growth factor 9 (glia-activating factor)/FGF9	600921	NM_002010	13q11-q12
	fibroblast growth factor 10/FGF10	602115	NM_004465	5p13-p12
	fibroblast growth factor 11/FGF11	601514	NM_004112	17q21
	fibroblast growth factor 12/FGF12	601513	*****	3q28
	fibroblast growth factor 13/FGF13	300070	NM_004114	Xq26.3
	fibroblast growth factor 14/FGF14	601515	NM_004115	13q34
	fibroblast growth factor 16/FGF16	603724	NM_003868	*****
	fibroblast growth factor 17/FGF17	603725	NM_003867	8p21
	fibroblast growth factor 18/FGF18	603726	NM_003862	*****
	fibroblast growth factor 19/FGF19	603891	NM_005117	*****
	fibroblast growth factor receptor 1/FGFR1	136350	*****	8p11.2-p11.1
	Receptors	fibroblast growth factor receptor 2 (bacteria-expressed kinase, keratinocyte growth factor receptor, craniofacial dysostosis 1, Crouzon syndrome, Pfeiffer syndrome, Jackson-Weiss syndrome)/FGFR2	176943	NM_000141

		fibroblast growth factor receptor 3 (achondroplasia, thanatophoric dwarfism)/FGFR3	134934	NM_00524 7	4p16.3
		fibroblast growth factor receptor 4/FGFR4	134935	NM_00201 1	5q35.1-qter
Signaling		FGFR1 oncogene partner/FOP	*****	NM_007045	*****
		suc1-associated neurotrophic factor target 1 (FGFR signalling adaptor)/SNT1	*****	NM_006654	*****
		suc1-associated neurotrophic factor target 2 (FGFR signalling adaptor)/SNT2	*****	NM_006653	*****
		sonic hedgehog (Drosophila) homolog/SHH	600725	NM_000193	7q36
Biosynthesis		Indian hedgehog (Drosophila) homolog/IHH	600726	L38517	2q33-q35
		patched (Drosophila) homolog/PTCH	601309	NM_000264	9q22.3
Receptors		nerve growth factor, alpha subunit/NGFA	162020	*****	*****
		nerve growth factor, beta	162030	*****	1p13.1
		nerve growth factor, gamma subunit/NGFG	162040	*****	19q13.3
		nerve growth factor receptor (TNFR superfamily, member 16)/NGFR	162010	NM_002507	17q21-q22
Biosynthesis		neurotrophin 3/NTF3	162660	NM_002527	12p13
		neurotrophin 5 (neurotrophin)	162662	NM_006179	19q13.3
		neurotrophin 6, alpha/NTF6A	604021	NM_004149	19q13.3
		neurotrophin 6, beta/NTF6B	604022	NM_004150	19q13.3
Receptors		neurotrophin 6, gamma/NTF6G	604023	NM_004151	19q13.3

Name of bank:

neurotrophic tyrosine kinase receptor	Receptors	191315	Y09033	1q21-q22
	type 1/NTRK1			
	neurotrophic tyrosine kinase receptor type 2/NTRK2	600456	NM_006180	9q22.1
neurotrophic tyrosine kinase receptor	type 3/NTRK3	191316	NM_002530	15q25
	phosphatidylinositol 3-kinase, regulatory subunit, polypeptide 1 (p85, alpha)/PIK3R1	171833	M61906	5q13
	phosphatidylinositol 3-kinase, regulatory subunit, polypeptide 2 (p85, beta)/PIK3R2	603157	NM_005027	19q13.2-q13.4
Phosphatidylinositol Kinases	phosphatidylinositol 3-kinase, regulatory subunit, polypeptide 3 (p55, gamma)/PIK3R3	*****	NM_003629	*****
	phosphoinositide-3-kinase, catalytic, alpha polypeptide/PIK3CA	171834	NM_006218	3q26.3
	phosphoinositide-3-kinase, catalytic, beta polypeptide/PIK3CB	602925	NM_006219	*****
	phosphatidylinositol 3-kinase, catalytic, delta polypeptide/PIK3CD	602839	NM_005026	1p36.2
	phosphatidylinositol 3-kinase, catalytic, gamma polypeptide/PIK3CG	601232	NM_002649	*****
	son of sevenless (Drosophila) homolog 1/SOS1	182530	NM_005633	2p22-p21
RAS/RAF	v-Ha-ras Harvey rat sarcoma viral oncogene homolog/HRAS	190020	NM_005343	11p15.5
	v-Ki-ras2 Kirsten rat sarcoma 2 viral oncogene homolog/KRAS2	190070	NM_004985	12p12.1

<b>Mediators</b>	neuroblastoma RAS viral (v-ras) oncogene homolog/NRAS	164790	NM_002524	1p13.2
	Ras-related associated with diabetes/RRAD	179503	NM_004165	16q22
	v-raf-1 murine leukemia viral oncogene homolog 1/RAF1	164760	NM_002880	3p25
<b>Hormone Signalling</b>	mitogen activated protein kinase PRKM1/MAPK1	176948	NM_002745	22q11.2
	mitogen activated protein kinase PRKM3/MAPK3	601795	X60188	16p11.2
	mitogen activated protein kinase PRKM4/MAPK4	176949	NM_002747	18q12-q21
	mitogen activated protein kinase PRKM6/MAPK6	602904	NM_002748	*****
	mitogen activated protein kinase PRKM7/MAPK7	602521	NM_002749	17p11.2
	mitogen activated protein kinase JNK1/PRKM8/MAPK8	601158	L26318	*****
	mitogen activated protein kinase JNK2/PRKM9/MAPK9	602896	U09759	5q35
	mitogen activated protein kinase JNK3/PRKM10/MAPK10	602897	U35003	*****
	mitogen activated protein kinase PRKM11/MAPK11	602898	AF031135	*****
	mitogen activated protein kinase SAPK3/MAPK12	602399	NM_002969	22q13.3
	mitogen activated protein kinase PRKM13/MAPK13	602899	NM_002754	*****
	mitogen activated protein kinase SAPK2A/MAPK14	600289	NM_001315	6p21.3-p21.2
	<b>Protein Kinases</b>			

Protein Phosphatase s	protein tyrosine phosphatase, non-receptor type 1/PTPN1	176885	NM_002827	20q13.1-q13.2
	protein tyrosine phosphatase, receptor type, F/PTPRF	179590	NM_002840	1p32
	protein phosphatase 1, catalytic subunit, alpha isoform/PPP1CA	176875	NM_002708	11q13
	phogrin/LAR/receptor-like protein-tyrosine phosphatase precursor/LAR	601698	AF007555	7q36
	protein tyrosine phosphatase, receptor type, N/PTPRN	601773	NM_002846	2q35-q36.1
Other	protein phosphatase 1, regulatory (inhibitor) subunit 2/PPP1R2	601792	NM_006241	3q29
	insulin induced gene 1/INSIG1	602055	NM_005542	7q36
Gluconeogenesis	pyruvate carboxylase/PC	266150	NM_000920	11q13.4-q13.5
	phosphoenolpyruvate carboxykinase 1 (soluble)/PEPCK1/PCCK1	261680	NM_002591	20q13.31
	phosphoenolpyruvate carboxykinase 2 (mitochondrial)/PEPCK2/PCK2	261650	NM_004563	*****
	aminomethyltransferase (glycine cleavage system protein T)/AMT	238310	NM_000481	3p21.2-p21.1
	glycine decarboxylase (glycine cleavage system protein L)/GLDC	238300	NM_000170	9p22
Glycogen Storage	glycogenin/GYG	603942	NM_004130	3q24-q25.1
	glycogenin 2/GYG2	300198	NM_003918	Xp22.3

Regulation of Glycogen Metabolism	glycogen synthase 1 (muscle)/GYS1	138570	NM_00210 3	19q13.3
	glycogen synthase 1 (liver)/GYS2	138571	AJ003087	12p12.2
	phosphorylase kinase, alpha 1 (muscle), muscle	311870	NM_00263 7	Xq13
	phosphorylase kinase, alpha 2 (liver), glycogen storage disease IX/PHKA2	306000	NM_00029 2	Xp22.2- p22.1
	phosphorylase kinase, beta/PHKB	172490	NM_000293	16q12-q13.1
	phosphorylase kinase, gamma 2 (testis)	172471	NM_000294	6p12.1-p11.2
	protein phosphatase 1, regulatory (inhibitor) subunit 3 (glycogen and sarcoplasmic reticulum binding subunit, skeletal muscle)/PPP1R3	600917	NM_00271 1	*****
	albumin proximal factor/transcription factor 1/TCF1/hepatic nuclear factor/HNF1	142410	NM_00054 5	12q24.2
	transcription factor 2/TCF2/hepatic nuclear factor 2/HNF2	189907	NM_00648 1	17cen-q21.3
	hepatocyte nuclear factor 3, alpha/HNF3A	602294	NM_00449 6	14q12-q13
	hepatocyte nuclear factor-3 beta/HNF3B	600288	AF176110	20p11
	hepatocyte nuclear factor 3, gamma/HNF3G	602295	NM_00449 7	19q13.2- q13.4
	hepatocyte nuclear factor 4, alpha/HNF4A	600281	NM_00045 7	20q12- q13.1
	hepatocyte nuclear factor 6/HNF6	604164	AH007195	15q21.1- q21.2

Metabolism	Uptake	insulin-regulated syntaxin 4 binding protein/SYNIP	*****	*****	*****	
		glucose-6-phosphatase, transport (glucose-6-phosphate) protein 1	602671	NM_001467	11q23	
		Solute carrier family 5, member 1/SLC5A1/SGLT1 (glucose)	182380	AH005284	22q13.1	
		Solute carrier family 2 (facilitated glucose transporter), member 1/SLC2A1/GLUT1 (glucose)	138140	NM_006516	1p35-p31.3	
		Solute carrier family 2, member 2/SLC2A2/GLUT2 (glucose)	138160	*****	3q26.1-q26.3	
		Solute carrier family 2, member 3/SLC2A3/GLUT3 (glucose)	138170	M20681	12p13.3	
		Solute carrier family 2, member 4/SLC2A4/GLUT4 (glucose)	138190	NM_001042	17p13	
		Solute carrier family 2, member 5/SLC2A5/GLUT5 (glucose)	138230	NM_003039	1p36.2	
		Glycogen Breakdown	phosphorylase, glycogen; muscle (McArdle syndrome, glycogen storage disease type V)/PYGM	232600	NM_005609	11q13
			phosphorylase, glycogen; liver (Hers disease, glycogen storage disease type VI)/PYGL	232700	NM_002863	14q21-q22
phosphorylase, glycogen; brain, nuclear gene encoding mitochondrial protein/PYGB	138550		NM_002862	20p11.2-p11.1		
glucosylase, alpha; acid (Hers disease, glycogen storage disease type VII)/GAA	232300		NM_000152	17q25.2-q25.3		

	amylo-1,6-glucosidase, 4-alpha-glucanotransferase (glycogen debranching enzyme, glycogen storage disease type III)/AGL	232400	NM_000642	1p21
Glycolysis	hexokinase 2, nuclear gene encoding mitochondrial protein/HK2	601125	NM_000189	2p12
	glucokinase (hexokinase 4, maturity onset diabetes of the young 2) nuclear gene encoding mitochondrial protein/GCK	138079	NM_000162	7p15-p13
	phosphofructokinase, muscle/PFKM	232800	NM_000289	12q13.3
	pyruvate kinase, muscle/PKM2	179050	NM_002654	15q22
	pyruvate kinase, liver/PKL	*****	D13243	*****
	pyruvate dehydrogenase (lipoamide) alpha 1/PDHA1	312170	NM_000284	Xp22.2-p22.1
	pyruvate dehydrogenase (lipoamide) alpha 2/PDHA2	179061	NM_005390	4q22-q23
	pyruvate dehydrogenase (lipoamide) beta 1/PDHFB1	179060	NM_000925	3p13-q23
	pyruvate dehydrogenase dihydrolipoamide dehydrogenase/PDHXL	246900	NM_000108	7q31-q32
	pyruvate dehydrogenase lipoyl-containing subunit gamma 1/PDHFG1	245349	NM_003477	11p13
	beta-galactosidase/GLB1	230500	M22590	3p21.33
	cathepsin A/CSTA/protective protein for beta-galactosidase (galactosialidosis)/PPGB	256540	NM_000308	20q13.1



	Glycolytic (and Other) Protein Maturation and Targeting	Lysosomal Targeting of Glycolytic Enzymes	amyloid precursor protein secretase/cathepsin B/CTSB	116810	NM_001908	8p22
			dipeptidyl-peptidase I/DPP1/cathepsin C/CTSC	602365	NM_001814	1q14.1-q14.2
			cathepsin D (lysosomal aspartyl protease)/CTSD	116840	NM_001909	11p15.5
			cathepsin E/CTSE	116890	NM_001910	1q31
			cathepsin F/CTSF	603539	AF132894	11q13
			cathepsin G/CTSG	116830	NM_001911	14q11.2
			granzyme H/GZMH/cathepsin G-like 2/CSTGL2	116831		14q11.2
			cathepsin H/CTSH	116820	NM_004390	15q24-q25
			cathepsin K (pycnodysostosis)/CTSK	601105	NM_000396	1q21
			cathepsin L/CTSL	116880	NM_001912	9q21-q22
			cathepsin L2/CTSL2	*****	NM_001333	*****
			cathepsin O/CTSO	600550	NM_001334	4q31-q32
			cathepsin S/CTSS	116845	NM_004079	1q21
			cathepsin U/CTSU	*****	AF070448	*****
			cathepsin V/CTSV	*****	AB001928	*****
			cathepsin W/CTSW	602364	NM_001335	11q13.1
			cathepsin X precursor/CTSX	*****	AF073890	*****
			cathepsin Z/CTSZ	603169	NM_001336	20q13
			mannosyltransferase polypeptide 1 mannosyltransferase polypeptide 2	603503	NM_003859	*****
			mannosyltransferase polypeptide 2 dolichyl-phosphate (UDP-N- acetylglucosamine) N- acetylglucosaminophosphotransferase 1 (GlcNAc-1-P transferase)/DPAGT1	603564	NM_003863	*****
				191350	NM_001382	11q23.3

Protein Glycosylation (enzymatic and non- enzymatic)	Sugar and Transition Metal Metabolism	aldose reductase/aldo-keto reductase family 1, member A1 (aldehyde reductase)/AKR1A1	103880	NM_00606 6	7q35
		sorbitol dehydrogenase/SORD	182500	NM_00310 4	15q15.3
		glutamine-fructose-6-phosphate transaminase 1/GFPT1	138292	NM_00205 6	2p13
		glutamine-fructose-6-phosphate transaminase 2/GFPT2	603865	NM_00511 0	5q34-q35
		receptor for advanced glycation end products/RAGE/AGER	600214	AJ133822	6p21.3
		glutamate-cysteine ligase (gamma- glutamylcysteine synthetase), catalytic (72.8kD)/GLCLC	230450	NM_00149 8	6p12
		glutathione synthetase/GSS	601002	NM_00017 8	20q11.2
		ATP-binding cassette 7 (iron transporter)/ABCB7	300135	NM_00429 9	Xq13.1- q13.3
		transferrin/TF	190000	NM_00106 3	3q21
		hepatocyte growth factor/HGF	142409	G_HUMHG	7q21.1
		hepatocyte growth factor receptor/oncogene MET/MET/HGFR	164860	NM_00024 5	7q31
		vascular endothelial growth factor/VEGFA	192240	NM_00337 6	6p12
		vascular endothelial growth factor/VEGFB	601398	NM_00337 7	11q13
		vascular endothelial growth factor/VEGFC	601528	NM_00542 9	*****
		VEGF receptor/VEGFR	191306	AF063657	4q12

Neovascularization	Vascular Growth Factors and Inhibitors	growth hormone/GH1	139250	NM_000515	17q22-q24
		growth hormone receptor/GHR	600946	NM_000163	5p13-p12
		pigment epithelium-derived	172860	NM_002615	17p13.3
		angiostatin/plasminogen/PLG	173350	NM_000301	6q26
		endostatin/type XVIII			
		collagen/COL18A1	120328	AF018081	21q22.3
		endothelin 1/EDN1	131240	NM_001955	6p24-p23
		endothelin 2/EDN2	131241	NM_001956	1p34
		endothelin 3/EDN3	131242	NM_000114	20q13.2-q13.3
		endothelin A receptor isoform delta			
		3/EDNRA	131243	AF014826	Chr.4
		endothelin receptor type B/EDNRB	131244	NM_000115	13q22
		protein kinase C beta/PRKCB	176970	X06318	16p11.2
		transforming growth factor, beta-1/TGFB1	190180	M60315	9q13.1-q13.2
		transforming growth factor, beta-2/TGFB2	190220	NM_003238	1q41
		transforming growth factor, beta-3/TGFB3	190230	NM_003239	14q24
		transforming growth factor, beta receptor I (activin A receptor type II-like kinase, 53kD)/TGFBRI	190181	NM_004612	9q33-q34
		transforming growth factor, beta receptor II (70-80kD)/TGFBRII	190182	NM_003242	3p22
		transforming growth factor, beta receptor III (betaglycan, 200kD)/TGFBRIII	600742	NM_003243	1p33-p32
		decorin/DCN	125255	NM_001920	12q23
		Munc13	*****	AF020202	*****

Hypertension Stress (hypoxia, vascular endothelium thickening, and hypertension)		transient receptor potential channel 3 (diacylglycerol-activated non-selective cation channel)/TRPC3	602345	NM_003305	*****
		transient receptor potential channel 6 (diacylglycerol-activated non-selective cation channel)/TRPC6	603652	NM_004621	11q21-q22
	Ion Pump	solute carrier family 12, member 3/SLC12A3 (renal sodium/chloride transporter)	600968	NM_000339	16q13
	Angiotensin	renin/REN	179820	NM_000537	Xq28
		renin-binding protein/RENBP	312420	NM_002910	1q32
		angiotensinogen/AGT	106150	NM_000029	1q42-q43
		angiotensin II type 1 receptor/AGTR1	106165	M87290	3q21-q25
		guanine nucleotide binding protein (G protein), beta polypeptide 3/GNB3	139130	NM_002075	12p13
	Natriuretic Peptide	dipeptidyl carboxypeptidase 1 (angiotensin I converting enzyme)/ACE/DCP1	106180	NM_000789	17q23
		atrial natriuretic peptide precursor A/NPPA	108780	X01471	1p36.2
		atrial natriuretic peptide precursor B/NPPB	600295	*****	1p36.2
		atrial natriuretic peptide precursor C/NPPC	600296	D28874	2q24-qter
		natriuretic peptide receptor A/ANPRA/NPR1	108960	*****	1q21-q22
		natriuretic peptide receptor B/ANPRB/NPR2	108961	*****	9p21-p12

Blood Pressure Regulation <i>(additional genes in Cardiovascular and Renal)</i>		natriuretic peptide receptor C/ANPRC/NPR3	108962	NM_000908	5p14-p12
	Endothelin	endothelin 1/EDN1	131240	NM_001955	6p24-p23
		endothelin 2/EDN2	131241	NM_001956	1p34
		endothelin 3/EDN3	131242	NM_000114	20q13.2-q13.3
		endothelin converting enzyme 1/ECE1	600423	NM_001397	1p36.1
		endothelin A receptor isoform delta 3/EDNRA	131243	AF014826	Chr.4
		endothelin receptor type B/EDNRB	131244	NM_000115	13q22
	Vasopressin	arginine vasopressin (neurophysin II, antidiuretic hormone, diabetes insipidus, neurohypophyseal)/AVP	192340	NM_000490	20p13
		arginine vasopressin receptor 1A/AVPR1A	600821	NM_000706	12q14-q15
		arginine vasopressin receptor 1B/AVPR1B	600264	NM_000707	1q32
		arginine vasopressin receptor 2 (nephrogenic diabetes leucyl/cystinyl)	304800	NM_000054	Xq28
			151300	NM_005575	*****
Nitric Oxide Pathway <i>(additional Genes in Cardiovascular and Renal)</i>	nitric oxide synthetase 1/NOS1	163731	AH001515	2q24.2-q24.3	
	nitric oxide synthetase 2A/NOS2A	163730	X85766	17cen-q11.2	
	macrophage nitric oxide synthetase 2B/NOS2B	600719	AH006623	17p13.1-q25	
	macrophage nitric oxide synthetase 2C/NOS2C	600720	600720	17p13.1-q25	
	nitric oxide synthetase 3/NOS3	163729	AH001515	7q36	
	chondrocyte nitric oxide synthetase 3/NOS4	163728	X73029	*****	
	arginase/ARG1	207800	NM_000045	*****	

	arginase/ARG2	107830	NM_001172	4q24.1-q24.3
Ion Channels	ATP sensitive potassium inwardly-rectifying channel, subfamily J, member 5/KCNJ5	600734	NM_000890	11q24
	transient receptor potential channel 3 (diacylglycerol-activated non-selective cation channel)/TRPC3	602345	NM_003305	*****
	transient receptor potential channel 6 (diacylglycerol-activated non-selective cation channel)/TRPC6	603652	NM_004621	11q21-q22
	potassium large conductance calcium-activated channel, subfamily M, alpha member 1/KCNMA1	600150	NM_002247	10q22
	potassium large conductance calcium-activated channel, subfamily M, beta member 1/KCNMB1	603951	NM_004137	5q34
	superoxide dismutase 1/SOD1	147450	NM_000454	21q22.1
	superoxide dismutase 2, mitochondrial	147460	X65965	6q25.3
	glutamate-cysteine ligase (gamma-glutamylcysteine synthetase), catalytic (72.8kD)/GLCLC	230450	NM_001498	6p12
	glutathione synthetase/GSS	601002	NM_000178	20q11.2
	catalase/CAT	115500	NM_001752	11p13
Amelioration of Oxidative Stress	glutathione peroxidase 1/GPX1	138320	AF029317	3p21.3
	glutathione peroxidase 2 (gastrointestinal)/GPX2	138319	NM_002083	14q24.1:
Antioxidants and Free Radical Scavengers				

			glutathione peroxidase 3 (plasma)/GPX3	138321	NM_00208 4	5q32-q33.1
			glutathione peroxidase 4 (phospholipid hydroperoxidase)/GPX4	138322	NM_00208 5	19p13.3
			glutathione peroxidase 5 (epididymal androgen-related protein)/GPX5	603435	NM_00150 9	*****
			apolipoprotein (a), Lp(a)/LPA	152200	NM_005577	6q27
			RBP5/cellular retinoic acid-binding protein 1/CRABP1	180230	NM_004378	15q24
			cellular retinoic acid-binding protein 2/CRABP2	180231	NM_001878	1q21.3
			retinol-binding protein 1,	180260	NM_002899	3q21-q22
			retinol-binding protein 2,	180280	NM_004164	3q21-qter
			retinol-binding protein 3, interstitial/RBP3	180290	NM_002900	10q11.2
			retinol-binding protein 4, interstitial/RBP4	180250	NM_006744	10q24
			serum vitamin D-binding protein/DBP/group-specific component/GC	139200	L10641	4q12
			transthyretin (prealbumin, amyloidosis type 1)/TTR	176300	NM_00037 1	18q11.2- q12.1
			Retinoic acid receptor, alpha/RARA	180240	NM_00096 4	17q12
			Retinoic acid receptor, beta/RARB	180220	NM_00096 5	3p24
			Retinoic acid receptor, gamma/RARG	180190	NM_00096 6	12q13

## Transport

Retinoids	Receptors and Coactivators	Retinoid X receptor alpha/RXRA	180245	NM_005693	9q34.3
		Retinoid X receptor beta/RXRB	180246	X66424	6p21.3
		Retinoid X receptor gamma/RXRG	180247	U38480	1q22-q23
		RAR-related orphan receptor A/RORA	600825	NM_002943	15q21-q22
		RAR-related orphan receptor B/RORB	601972	*****	15q21-q22
		RAR-related orphan receptor C/RORC	602943	NM_005060	1q21
		nuclear receptor coactivator 2/GRIP1	601993	NM_006540	*****
		silencing mediator for retinoid and thyroid hormone receptors/SMRT	600848	NM_006312	*****
		retinoic and thyroid hormone receptor associated corepressor			
		1/TRAC1/NCOR1	600849	NM_006311	*****
Adipocyte Differentiation	Catabolism	UDP glycosyltransferase 1/UGT1	191740	NM_001072	Chr. 12
		UDP glycosyltransferase family 2, member B4/UGT2B4	600067	NM_001073	4q13
		UDP glycosyltransferase family 2, member B7/UGT2B7	600068	NM_001074	1q14
		UDP glycosyltransferase 2 family, polypeptide B11/UGT2B11	603064	NM_001073	*****
		UDP glycosyltransferase family 2, member B15/UGT2B15	600069	NM_001076	4q13
		UDP glycosyltransferase family 2, member B17/UGT2B17	601903	NM_001077	1q14
		Peroxisome proliferative activated receptor, alpha/PPARA	170998	NM_005036	22q12-q13.1



Peroxisome Proliferation	Receptors and Coactivators	Peroxisome proliferative activated receptor, delta/PPARD	6E+05	NM_00623 8	1q21.3
		peroxisome proliferative activated receptor, gamma/PPARG	601487	NM_005037	3p25
		CCAAT/enhancer binding protein (C/EBP), alpha/CEBPA	116897	NM_00436 4	19q13.1
		CCAAT/enhancer binding protein (C/EBP), beta/CEBPB	189965	NM_005194	20q13.1
		CCAAT/enhancer binding protein (C/EBP), gamma/CEBPG	138972	NM_00180 6	Chr. 19
		CCAAT/enhancer binding protein (C/EBP), delta/CEBPD	116898	NM_00519 5	8p11.2- p11.1
		CCAAT/enhancer binding protein (C/EBP), epsilon/CEBPE	600749	NM_00180 5	14q11.2
		acetyl-Coenzyme A carboxylase alpha/ACACA	200350	NM_00066 4	17q21
		acetyl-Coenzyme A carboxylase beta/ACACB	601557	NM_00109 3	12q24.1
		acetyl-Coenzyme A acetyltransferase 1 (acetoacetyl Coenzyme A thiolase)/ACAT1	203750	NM_00001 9	11q22.3- q23.1
Biosynthesis		acetyl-Coenzyme A acetyltransferase 2 (acetoacetyl Coenzyme A thiolase)/ACAT2	100678	NM_00589 1	6q25.3-q26
		ATP citrate lyase/ACLY	108728	NM_00109 6	17q21.1
		glycerol-3-phosphate acyltransferase, mitochondrial/GPAM1	602395	*****	10q24-q26
		fatty acid synthase/FASN	600212	NM_00410 4	17q25

Transport	apolipoprotein A1 of HDL/APOA1	107680	NM_000039	11q23
	apolipoprotein A2/APOA2	107670	NM_001643	1q21-q23
	apolipoprotein A4/APOA4	107690	NM_000482	11q23
	apolipoprotein B (including Ag(x) antigen)/APOB	107730	NM_000384	2p24
	apolipoprotein B mRNA editing enzyme, catalytic polypeptide	600130	NM_005889	12p13.1
	APOBEC1 binding protein/ABBP1/heterogeneous nuclear ribonucleoprotein A/B/HNRPAB	602688	NM_004499	*****
	apolipoprotein C1/APOC1	107710	NM_001645	19q13.2
	apolipoprotein C2/APOC2	207750	NM_000483	19q13.2
	apolipoprotein C3/APOC3	107720	NM_000040	11q23
	apolipoprotein C4/APOC4	600745	NM_001646	19q13.2
	apolipoprotein D/APOD	107740	NM_001647	3q26.2-qter
	apolipoprotein E/APOE	107741	NM_000041	19q13.2
	apolipoprotein F/APOF	107760	NM_001638	Chr.12
	apolipoprotein H (beta-2-glycoprotein I)/APOH	138700	NM_000042	17q23-qter
	apolipoprotein J/clustrin/APOJ/CLU	185430	NM_001831	8p21-p12
	apolipoprotein L/APOL	603743	AF019225	Chr. 22
	pancreatic triglyceride lipase/PNLIP	246600	AH003527	10q26.1
	enterostatin/colipase, pancreatic/CLPS	120105	NM_001832	6pter-p21.1
	low density lipoprotein receptor (familial hypercholesterolemia)/LDLR	143890	NM_000527	9p13.2-p13.1
	low density lipoprotein receptor-related protein 1/LRP1	107770	NM_002332	2q13.1-q13.2
	low density lipoprotein receptor-related protein 2/LRP2	600073	U33837	2q24-q31

Lipid Metabolism and Storage	Lipid Metabolism and Storage	Uptake			
		low density lipoprotein receptor-related protein 5/LRP5	603506	AF077820	11q13.4
		low density lipoprotein receptor-related protein 8/LRP8	602600	NM_004631	1p34
		low density lipoprotein receptor-related protein-associated protein oxidized low density lipoprotein receptor/OLR1	104225	NM_002337	4p16.3
		very low density lipoprotein receptor/VLDLR	602601	NM_002543	12p13-p12
		microsomal triglyceride transfer protein large subunit/MTP	192977	NM_003383	9p24
		soritin related receptor/SORL1	157147	NM_000253	4q22-q24
		plasma cholesterol ester transfer protein/CETP	602005	NM_003105	1q23.2-q24.2
		phospholipid transfer protein/PLTP	118470	NM_000078	16q21
		glycerol-3-phosphate acyltransferase, mitochondrial/GPAM1	172425	NM_006227	20q12-q13.1
		lipoprotein lipase/LPL	602395	*****	10q24-q26
		lipase, hepatic/LIPC	238600	NM_000237	8p22
		adrenergic, beta-3-, receptor/ADRB3	151670	NM_000236	15q21-q23
		lysosomal acid lipase/LIPB	109691	NM_000025	8p12-p11.2
		lipase, hormone-sensitive/LIPE	278000	NM_000235	10q24-q25
		perilipin/PLIN	151750	NM_005357	9q13.1-q13.2
		fatty acid binding protein 4, adipocyte/FABP4	170290	NM_002666	15q26
		Fatty acid CoA Ligase, long chain 1/FACL1	600434	NM_001442	8q21
			152425	*****	3q13

Coenzyme A Ligases	Fatty acid CoA Ligase, long chain 2/FACL2	152426	*****	4q34-q35
	Fatty acid CoA Ligase, long chain 3/FACL3	602371	NM_00445 <sub>7</sub>	2q34-q35
	Fatty acid CoA Ligase, long chain 4/FACL4	300157	NM_00445 <sub>8</sub>	Xq22.3
	Fatty acid CoA Ligase, very long chain 1/FACVL1	603247	NM_00364 <sub>5</sub>	15q21.2
β-Oxidation	acyl-Coenzyme A dehydrogenase, long	201460	NM_001608	2q34-q35
	acyl-Coenzyme A dehydrogenase, C-4	201450	NM_000016	1p31
	acyl-Coenzyme A dehydrogenase, C-2	201470	NM_000017	12q22-qter
	carnitine palmitoyltransferase I, liver, nuclear gene encoding mitochondrial protein/CPT1A	600528	NM_001876	11q13
	carnitine palmitoyltransferase II, nuclear gene encoding mitochondrial protein/CPT2	600650	NM_000098	1p32
	carnitine/acylcarnitine	212138	NM_000387	3p21.31
	Enoyl-CoA, hydratase/3-hydroxyacyl CoA dehydrogenase/EHHADH	261515	NM_00196 <sub>6</sub>	3q27
	hydroxyacyl-CoA dehydrogenase/3-ketoacyl-CoA thiolase/enoyl-CoA hydratase, alpha subunit/HADHA	600890	NM_00018 <sub>2</sub>	2p23
	hydroxyacyl-CoA dehydrogenase/3-ketoacyl-CoA thiolase/enoyl-CoA hydratase, beta subunit/HADHB	143450	NM_00018 <sub>3</sub>	2p23
	acyl-Coenzyme A oxidase 1/ACOX1 (peroxisomal)	264470	NM_00403 <sub>5</sub>	17q25
	acyl-Coenzyme A oxidase 2, branched chain/ACOX2 (peroxisomal)	601641	NM_00350 <sub>0</sub>	3p14.3

		acyl-Coenzyme A dehydrogenase, C-2 to C-3 short chain precursor/ACADS (mitochondrial)	201470	NM_000017	12q22-qter
		acyl-Coenzyme A dehydrogenase, C-4 to C-12 straight chain/ACADM (mitochondrial)	201450	NM_000016	1p31
		acyl-Coenzyme A dehydrogenase, long chain/ACADL (mitochondrial)	201460	NM_001608	2q34-q35
		hydroxyacyl-Coenzyme A dehydrogenase, type II/HADH2	602057	NM_004493	*****
		enoyl-Coenzyme A hydratase 1/ECH1 (peroxisomal)	600696	NM_001398	19q13
<b>Regulation</b> (see also parathyroid hormone)		calcitonin/calcitonin gene-related peptide	114130	NM_001741	1p15.2-p15.1
		calcitonin/calcitonin gene-related peptide	114160	X02404	1p15.2-p15.2
		calcitonin receptor/CALCR	114131	NM_001742	7q21.3
		calcitonin receptor-like/CALCRL	114190	NM_005795	*****
		stanniocalcin/STC1	601185	NM_003155	8p21-p11.2
		sodium-calcium exchanger (isoform Na)	182305	AF128524	2p23-p22
		sodium-calcium exchanger (isoform Na)	601901	*****	Chr.14
		solute carrier family 12 (sodium/potassium/chloride transporters), member 1/SLC12A1	600839	NM_000338	15q15-q21.1
		regucalcin (senescence marker protein-30)/RGN	300212	NM_004683	Xp11.2-q11.2
		bone gamma-carboxyglutamate (gla) protein (osteocalcin)/BGLAP	112260	NM_000711	1q25-q31
<b>Calcium Metabolism</b>		matrix gamma-carboxyglutamate (gla) protein/MGP/MGLAP	154870	NM_000900	12p13.1-p12.3
<b>Uptake</b>					
<b>Efflux</b>					

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<b>Calcium Homeostasis</b>	<b>Calcium Deposition</b>	gamma-glutamyl carboxylase/GGCX	137167	NM_000821	2p12
		secreted phosphoprotein 1/SPPL1/osteopontin-binding sialoprotein (bone sialoprotein, bone sialoprotein 1)	166490	D14813	4q21-q25
<b>Calcium Homeostasis</b>	<b>Bone Growth Factors and Receptors</b>	vitamin D (1,25-dihydroxyvitamin D3) receptor/VDR	147563	NM_004967	4q21-q25
		core binding factor alpha 1 subunit/CBFA1/runt-related transcription factor 2/osteoblast-transcription factor 2/osteoblast-osteonectin/ON/secreted protein, acidic, cysteine-rich/SPARC	601769	NM_000376	12q12-q14
		osteoprotegerin ligand/OPGL/tumor necrosis factor receptor superfamily, member 11a, activator of NFkB/TNFRSF11A	600211	AH005498	6p21
		bone morphogenetic protein 1/BMP1	182120	NM_003118	5q31.3-q32
		bone morphogenetic protein 2 precursor/BMP2			
		bone morphogenetic protein 3 (osteogenic) precursor/BMP3	602642	NM_003839	13q14
		bone morphogenetic protein 4/BMP4	112264	NM_006132	8p21
		bone morphogenetic protein 5/BMP5	112261	NM_001200	20p12
		bone morphogenetic protein 6/BMP6			
		osteogenic protein 1/OP1/bone morphogenetic protein 7 precursor/BMP7	112263	NM_001201	4p14-q21
		osteogenic protein 2/OP2/bone morphogenetic protein 8 precursor/BMP8	112262	NM_001202	14q22-q23
			112265	*****	Chr. 6
			112266	NM_001718	6p24-p23
			112267	NM_001719	Chr.20
			602284	NM_001720	1p35-p32

<b>Receptors</b>	osteoprotegerin/OPG/tumor necrosis factor receptor superfamily, member 11b/TNFRSF11B	602643	NM_002546	8q24
	bone morphogenetic protein receptor, type IA/BMPRI A	601299	NM_004329	10q22.3
	bone morphogenetic protein receptor, type IB/BMPRI B	603248	NM_001203	4q23-q24
	bone morphogenetic protein receptor, type II precursor (serine/threonine kinase)/BMPRI 2	600799	NM_001204	2q33-q34
	cytochrome P450, subfamily XXVIIIB (25-hydroxyvitamin D-1-alpha-hydroxylase), polypeptide 1/CYP27B1	264700	NM_000785	12q14
<b>Biosynthesis</b>	vitamin D (1,25-dihydroxyvitamin D3) receptor/VDR	601769	NM_000376	12q12-q14
	nuclear receptor coactivator 2/GRIP1	601993	NM_006540	*****
<b>Receptors</b>	vitamin D3 receptor interacting protein/DRIP80	*****	AF105421	*****
	vitamin D3 receptor interacting protein/DRIP92	*****	AF106934	*****
	vitamin D3 receptor interacting protein/DRIP130	*****	AF105332	*****
	cytochrome P450, subfamily XXIV (vitamin D 24-hydroxylase)/CYP24	126065	NM_000782	10q13.2-q13.3
<b>Signalling</b>	serum vitamin D-binding protein/DBP/group-specific component/GC	139200	L10641	4q12
	calbindin 3, (vitamin D-dependent calcium-binding protein)/CALB3	302020	NM_004057	Xp
<b>Metabolism</b>				

Vitamin D

Phosphate Homeostasis	Phosphate Metabolism	Regulation	X-linked hypophosphatemia protein/HYP/phosphate-regulating endopeptidase homolog, X-linked/PHEX/PEX				Xp22.2-p22.1
			307800	Y10196			
Uptake		alkaline phosphatase, liver/bone/kidney/ALPL	171760	NM_000478			1p36.1-p34
		solute carrier family 17 (sodium phosphate), member 1/SLC17A1	182308	NM_005074			6p23-p21.3
		solute carrier family 17 (sodium phosphate), member 2/SLC17A2	182309	NM_003052			5q35
		solute carrier family 17 (sodium phosphate), member 4/SLC17A4	604216	NM_005495			6p22-p21.3
		solute carrier family 20 (phosphate transporter), member 1/SLC20A1	137570	NM_005415			2q11-q14
		type II sodium-dependent phosphate transporter 3b/NAPI-3B/solute carrier family 34, member 2/SLC34A2	604217	NM_006424			*****
		interleukin 1 beta/IL1B	147720	AF043335			2q14
Interleukins		interleukin 1 receptor, type I/IL1R1	147810	NM_000877			2q12
		interleukin 1 receptor, type 2/IL1R2	147811	NM_004633			2q12-q22
		interleukin 6/IL6	147620	AF048692			7p21
		interleukin 6 receptor/IL6R	147880	NM_000565			1q21
Cytokines		transforming growth factor, beta-1/TGFB1	190180	M60315			9q13.1-q13.3
		transforming growth factor, beta-2/TGFB2	190220	NM_003238			1q41



	Transforming Growth Factor	transforming growth factor, beta-3/TGFB3	190230	NM_003239	14q24
		transforming growth factor, beta receptor I (activin A receptor type II-like kinase, 53kD)/TGFBRI	190181	NM_004612	9q33-q34
Inflammation (additional genes in Inflammation)	Adhesion Molecules	transforming growth factor, beta receptor II (70-80kD)/TGFBRII	190182	NM_003242	3p22
		transforming growth factor, beta receptor III (betaglycan, CD32)/TGFBRIII	600742	NM_003243	1p33-p32
		transforming growth factor, beta receptor V/vitronectin receptor/CD51/ITGAV	193210	NM_002210	2q31-q32
		transforming growth factor, beta receptor integrin, alpha5/fibronectin receptor, alpha subunit/FNRA/ITGA5	135620	NM_002205	12q11-q13
		transforming growth factor, beta receptor lymphocyte antigen CD11C/integrin, alpha-X/CD11C/ITGAX	151510	NM_000887	16p11.2
		transforming growth factor, beta receptor lymphocyte antigen CD11A/integrin, alpha-L/CD11A/ITGAL	153370	NM_002209	16p11.2
		transforming growth factor, beta receptor matrix metalloproteinase 1 (interstitial collagenase)/MMP1	120353	NM_002421	11q22-q23
		transforming growth factor, beta receptor matrix metalloproteinase-like 1/MMP1	*****	NM_004142	*****
		transforming growth factor, beta receptor matrix metalloproteinase 2 (neutrophil gelatinase)/CLG4/MMP2	120360	AH002654	16q13
		transforming growth factor, beta receptor matrix metalloproteinase 3 (stromelysin 1, progelatinase)/MMP3	185250	NM_002422	11q23
		transforming growth factor, beta receptor matrix metalloproteinase 8 (neutrophil collagenase)/MMP8	120355	NM_002424	11q21-q22

Adhesion	matrix metalloproteinase 9 (gelatinase B, 92kD gelatinase, 92kD type IV collagenase)/MMP9	120361	NM_004994	20q11.2-q13.1
	matrix metalloproteinase 10 (stromelysin 2)/MMP10	185260	NM_002425	11q22.3-q23
Proteases	matrix metalloproteinase 11 (stromelysin 3)/MMP11	185261	NM_005940	22q11.2
	matrix metalloproteinase 12 (macrophage elastase)/MMP12	601046	NM_002426	1q22.2-q22.3
	matrix metalloproteinase 13 (collagenase 3)/MMP13	600108	NM_002427	11q22.3
	matrix metalloproteinase 14 (membrane-inserted)/MMP14	600754	NM_004995	14q11-q12
	matrix metalloproteinase 15 (membrane-inserted)/MMP15	602261	NM_002428	16q13-q21
	matrix metalloproteinase 16 (membrane-inserted)/MMP16	602262	NM_005941	8q21
	matrix metalloproteinase 17 (membrane-inserted)/MMP17	602285	NM_004141	12q24.33
	matrix metalloproteinase 19/MMP19	601807	NM_002429	12q14
	matrix metalloproteinase 23A/MMP23A	603320	NM_004659	1p36.3
	matrix metalloproteinase 23B/MMP23B	603321	NM_006983	1p36.3
	matrix metalloproteinase 24 (membrane-inserted)/MMP24	*****	NM_006690	*****

Table 6. Cardiovascular and Renal Gene List

4czf01.xls

Class	Pathway	Function	Name	OMIM	GID	Locus
Dopamine Pathway	Biosynthesis		aromatic L-Amino Acid Decarboxylase/AADC/dopa decarboxylase	107930	AH005280	7p11
			tyrosine hydroxylase/TH	191290	NM_000360	11p15.5
			dopamine receptor D1/DRD1	126449	NM_000794	5q35.1
	Receptors		dopamine Receptor D2/DRD2	126450	NM_000795	11q23
			dopamine Receptor D3/DRD3	126451	NM_000796	3q13.3
			dopamine receptor D4/DRD4	126452	NM_000797	11p15.5
			dopamine receptor D5/DRD5	126453	NM_000798	4p16.1-p15.3
	Reuptake		solute carrier family 6 member 3/SLC6A3 (dopamine)	126455	NM_001044	5p15.3
			dopamine beta-hydroxylase (dopamine beta-monoxygenase)/DBH	223360	NM_000787	9q34
	Catabolism		catechol-O-methyltransferase/COMT	116790	NM_000754	22q11.2
			monoamine oxidase A, nuclear gene encoding mitochondrial	309850	NM_000240	Xp11.23
			monoamine oxidase B, nuclear gene encoding mitochondrial	309860	NM_000898	Xp11.23
			phenol-preferring sulfotransferase, family 1A, member 1/SULT1A1	171150	NM_001055	16p12.1-p11.2
			phenol-preferring sulfotransferase, family 1A, member 2/SULT1A2	601292	NM_001054	16p12.1-p11.2
			phenol-preferring sulfotransferase, family 1A, member 3/SULT1A3	600641	L19956	16p11.2
			dopamine beta-hydroxylase (dopamine beta-monoxygenase)/DBH	223360	NM_000787	9q34
			phenylethanolamine-N-methyltransferase/PNMT	171190	NM_002686	17q21-q22

4czf01\_.xls

		tyrosine hydroxylase/TH	191290	NM_000360	11p15.5
Epinephrine and Nor- epinephrine Pathway	Receptors	adrenergic receptor alpha-1A /ADRA1A	104219	NM_000678	Chr.20
		adrenergic receptor alpha-1B	104220	NM_000679	5q33
		adrenergic receptor alpha-1C /ADRA1C	104221	NM_000680	8p21
		adrenergic receptor alpha-1D /ADRA1D	104222	M76446	20p13
		adrenergic receptor alpha-2A (platelet)/ADRA2A	104210	NM_000681	10q24-q26
		adrenergic receptor alpha-2B (hepatic, renal)/ADRA2B	104260	NM_000682	Chr.2
		adrenergic receptor alpha-2C (renal)/ADRA2C	104250	NM_000683	4q16.1
		adrenergic receptor beta-1/ADRB1	109630	NM_000684	10q24-q26
		adrenergic receptor beta-2/ADRB2	109690	NM_000024	5q32-q34
		adrenergic receptor beta-3/ADRB3	109691	NM_000025	8p12-p11.2
	Signalling	beta-adrenergic receptor kinase 1/ADRBK1/BARK	109635	NM_001619	11cen-q13
		beta-adrenergic receptor kinase 2/ADRBK2	109636	X69117	22q11
		guanine nucleotide binding protein (G protein), beta polypeptide 2-like 1/GNB2L1	109760	NM_006098	5q11.2-q13
		arrestin, beta 1/ARRB1	107940	NM_004041	11q13
		vesicular amine transporter 2 / VAT2	193001	L09118	10q25
Reuptake		vesicular amine transporter 1/ VAT1	193002	*****	8p21.3
		Solute carrier family 6 , member 5/SLC6A2/NAT1/NET1	163970	NM_001043	16q12.2

Catabolism	mitochondrial monoamine oxidase A, nuclear gene encoding mitochondrial	309850	NM_000240	Xp11.23
	mitochondrial monoamine oxidase B, nuclear gene encoding mitochondrial	309860	NM_000898	Xp11.23
	catechol-O-methyltransferase/COMT	116790	NM_000754	22q11.2
	choline acetyltransferase/CHAT	118490	NM_003055	10q11.2
Biosynthesis	carnitine acetyltransferase/CRAT	600184	NM_004003	9q34.1
	apolipoprotein E	107741	NM_000041	19q13.2
	cholinergic receptor, muscarinic 1/CHRM1	118510	NM_000738	11q13
	cholinergic receptor, muscarinic 1/CHRM2	118493	NM_000739	7q35-q36
	cholinergic receptor, muscarinic 1/CHRM3	118494	U29589	1q41-q44
	cholinergic receptor, muscarinic 1/CHRM4	118495	NM_000741	11p12-p11.2
	cholinergic receptor, muscarinic 1/CHRM5	118496	AF026263	15q26
	cholinergic receptor, nicotinic, alpha polypeptide 1 (muscle) precursor/CHRNA1	100690	NM_000079	2q24-q32
	cholinergic receptor, nicotinic, alpha polypeptide 2 (neuronal)/CHRNA2	118502	NM_000742	Chr.8
	cholinergic receptor, nicotinic, alpha polypeptide 3 (neuronal) precursor/CHRNA3	118503	NM_000743	15q24
	cholinergic receptor, nicotinic, alpha polypeptide 4 (neuronal) precursor/CHRNA4			
		118504	NM_000744	20q13.2-q13.3

Acetylcholine Pathway	Receptors	cholinergic receptor, nicotinic, alpha polypeptide 5 (neuronal)	118505	NM_000745	15q24
		precursor/CHRNA5			
		cholinergic receptor, nicotinic, alpha polypeptide 6 (neuronal)	*****	NM_004198	*****
		precursor/CHRNA6			
		cholinergic receptor, nicotinic, alpha polypeptide 7 (neuronal)	118511	NM_000746	15q14
		precursor/CHRNA7			
		cholinergic receptor, nicotinic, beta polypeptide 1 (muscle)/CHRNA1	100710	NM_000747	17p12-p11
		cholinergic receptor, nicotinic, beta polypeptide 2 (neuronal)/CHRNA2	118507	NM_000748	1p21
		cholinergic receptor, nicotinic, beta polypeptide 3/CHRNA3	118508	NM_000749	8p11.2
		cholinergic receptor, nicotinic, beta polypeptide 4/CHRNA4	118509	NM_000750	15q24
		cholinergic receptor, nicotinic, epsilon polypeptide/CHRNAE	100725	NM_000080	Chr.17
		cholinergic receptor, nicotinic, delta polypeptide/CHRNA	100720	NM_000751	2q33-q34
		cholinergic receptor, nicotinic, gamma polypeptide/CHRNA	100730	NM_005199	2q33-q34
		solute carrier family 18 (vesicular acetylcholine), member 3/SLC18A3	600336	NM_003055	10q11.2
		precursor/ACH	100740	NM_000665	7q22
		butyrylcholinesterase 1/serum cholinesterase 1/BCHE1	177400	NM_000055	26.1-q26.2
	Reuptake				
	Catabolism				

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Biosynthesis	butyrylcholinesterase 2/serum cholinesterase 2/BCHE2	177500	*****	2q33-q35
	aromatic L-Amino Acid			
	Decarboxylase/AADC	107930	AH005280	7p11
	tryptophan hydroxylase (tryptophan 5-monooxygenase)/TPH	191060	NM_004179	11p15.3-p14
	14-3-3 protein tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, eta polypeptide/YWHAH	113508	NM_003405	22q12
	14-3-3 protein tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, epsilon polypeptide/YWHAH	*****	NM_006761	*****
	14-3-3 protein tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, zeta polypeptide/YWHAZ	601288	NM_003406	2p25.2-p25.1
	14-3-3 protein tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, beta polypeptide/YWHAB	601289	NM_003404	20q13.1
	14-3-3 protein tyrosine 3-monooxygenase/tryptophan 5-monooxygenase activation protein, theta polypeptide/YWHAQ	*****	NM_006826	*****
	G protein-coupled 5-hydroxytryptamine (serotonin)	109760	NM_000524	5q11.2-q13

Serotonin Pathway	Receptors	G protein-coupled 5- hydroxytryptamine (serotonin)	182131	NM_000863	6q13
		G protein-coupled 5- hydroxytryptamine (serotonin)	312861	U49516	Xq24
		G protein-coupled 5- hydroxytryptamine (serotonin)	182133	NM_000864	1p36.3-p34.3
		G protein-coupled 5- hydroxytryptamine (serotonin)	182132	NM_000865	6q14-q15
		G protein-coupled 5- hydroxytryptamine (serotonin)	182134	L05597	3p12
		G protein-coupled 5- hydroxytryptamine (serotonin)	182135	D87030	13q14-q21
		G protein-coupled 5- hydroxytryptamine (serotonin)	601122	NM_000867	2q36.3-q37.1
		G protein-coupled 5- hydroxytryptamine (serotonin)	312861	NM_000868	Xq24
		gated ion channel 5- hydroxytryptamine (serotonin)	182139	NM_000869	1q23.1-q23.2
		gated ion channel 5- hydroxytryptamine (serotonin)	*****	NM_006028	*****
		G protein-coupled 5- hydroxytryptamine (serotonin)	602164	Y08756	5q31-q33
		G protein-coupled 5- hydroxytryptamine (serotonin)	601305	X81411	7q36.1
		G protein-coupled 5- hydroxytryptamine (serotonin)	601109	NM_000871	1p36-p35
		G protein-coupled 5- hydroxytryptamine (serotonin)	182137	L21195	10q21-q24



Neuro- endocrine		Reuptake	solute carrier family 6 (neurotransmitter transporter, serotonin), member 4/SLC6A4	182138	NM_001045	17q11.1-q12
		Catabolism	monoamine oxidase A, nuclear gene encoding mitochondrial monoamine oxidase B, nuclear gene encoding mitochondrial serotonin N-Acetyltransferase/SNAT tryptophan 2,3-dioxygenase/TDO2 adenylosuccinate lyase/ADSL adenylosuccinate synthetase/ADSS	309850 309860 600950 191070 103050 103060	NM_000240 M69177 U40347 NM_005651 NM_000026 NM_001126	Xp11.23 Xp11.23 17q25 4q31-q32 22q13.1 1cen-q12
Adenosine	Receptors	Biosynthesis	adenosine A1 receptor (G-protein coupled)/ADORA1 adenosine A2a receptor (G-protein coupled)/ADORA2A adenosine A2b receptor (G-protein coupled)/ADORA2B adenosine A3 receptor (G-protein coupled)/ADORA3 adenosine A2 receptor- like/ADORA2L1	102775 102776 600446 600445 102777	NM_000674 NM_000675 NM_000676 NM_000677 *****	1q32.1 22q11.2 17p12-p11.2 1p21-p13 10q25.3-q26.1
		Receptors	purinergic receptor P2X, ligand-gated ion channel, 1/P2RX1 purinergic receptor P2X, ligand-gated ion channel, 3/P2RX3 purinergic receptor P2X, ligand-gated ion channel, 4/P2RX4 purinergic receptor P2X, ligand-gated ion channel, 5/P2RX5	600845 600843 600846 602836	NM_002558 NM_002559 NM_002560 NM_002561	***** 11q12 12q24.32 *****

Enzyme Control of Heart Rate, Vascular Tone, and Renal Function	Pathway				
		purinergic receptor P2X, ligand-gated ion channel, 7/P2RX7	602566	NM_002562	12q24
		purinergic receptor P2Y (G-protein coupled) 1/P2RY1	601167	NM_002563	3q25
		purinergic receptor P2Y (G-protein coupled) 2/P2RY2	600041	U07225	1q13.5-q14.1
		purinergic receptor P2Y (G-protein coupled) 4/P2RY4	300038	NM_002565	Xq13
		purinergic receptor P2Y (G-protein coupled) 6/P2RY6	602451	NM_004154	11q13.5
		leukotriene B4 receptor/purinergic receptor P2Y (G-protein coupled) 7/P2RY7	601531	NM_000752	14q11.2-q12
		purinergic receptor P2Y (G-protein coupled) 11/P2RY11	602697	NM_002566	*****
		Solute carrier family 29 (nucleosides), member 1/SLC29A1/ENT1	602193	NM_004955	6p21.2-p21.1
		Solute carrier family 29 (nucleosides), member 2/SLC29A2/ENT2	602110	X86681	11q13
		adenosine deaminase	102700	NM_000022	20q13.11
		Histidine Decarboxylase	142704	M60445	15q21-q22
Histaminergic Pathway	histamine H1 receptor/HRH1	600167	NM_000861	3p21-p14	
	histamine H2 receptor/HRH2	142703	AB023486	*****	
	histamine H3 receptor/HRH3	*****	NM_007232	*****	
	Histamine N-	*****	NM_006895	chr. 2	
	Amine oxidase (copper-containing) 2/AOC2	602268	D88213	17q21	

Nitric Oxide Pathway	Biosynthesis	Amine oxidase (copper-containing) 3/AOC3	603735	AF054985	17q21
		nitric oxide synthetase 1/NOS1	163731	AH001515	2q24.2-q24.3
		nitric oxide synthetase 2A/NOS2A	163730	X85766	17cen-q11.2
		macrophage nitric oxide synthetase 2B/NOS2B	600719	AH006623	17p13.1-q25
		macrophage nitric oxide synthetase 2C/NOS2C	600720	600720	17p13.1-q25
		nitric oxide synthetase 3/NOS3	163729	AH001515	7q36
		chondrocyte nitric oxide synthetase 3/NOS4	163728	X73029	*****
		arginase/ARG1	207800	NM_000045	*****
		arginase/ARG2	107830	NM_001172	4q24.1-q24.3
		guanylate cyclase 1, soluble, beta 2/GU	603695	AF038499	13q14.3
General Metabolism for Peptide Hormones	Receptors	guanylate cyclase 1, soluble, beta 3/GU	139397	NM_000857	4q32
		guanylate cyclase 1, soluble, alpha 3/G	139396	NM_000856	4q32
		guanylate cyclase 1, soluble, alpha 2/G	601244	NM_000855	11q21-q22
		membrane metalloendopeptidase/MME/neutral endopeptidase	120520	NM_000902	3q21-q27
		calpain, large polypeptide L3/CAPN3	114240	NM_000070	5q15.1-q21.1
		leucyl/cystinyl	151300	NM_005575	*****
		carboxypeptidase N polypeptide 1/CPN1	603103	NM_001308	chr. 10
		carboxypeptidase N polypeptide 2/regulatory subunit/CPN2	603104	J05158	8p23-p22
		meprin alpha subunit/MEP1A	600388	NM_005925	6p21.2-p21.1
		meprin beta subunit/MEP1B	600389	NM_005925	8q12.2-q12.3
Biosynthesis and Catabolism	Biosynthesis and Catabolism	prolyl endopeptidase/PREP	600400	NM_002726	6q22

		neuroendocrine convertase 1/NEC1	162150	D73407	5q14-q21
		peptidylglycine alpha-amidating monooxygenase /PAM/NEC2	170270	NM_000919	5q14-q21
		paired basic amino acid cleaving enzyme/PACE/FUR	136950	X04329	15q25-q26
	<b>Biosynthesis</b>	Cholecystokinin/CCK	118440	NM_000729	3pter-p21
<b>Cholecystokinin (CCK)</b>	<b>Receptors</b>	Cholecystokinin A receptor/CCKAR	118444	NM_000730	4p15.2-p15.1
	<b>Biosynthesis</b>	Cholecystokinin B receptor/CCKBR	118445	NM_000731	1p15.5-p15.4
		Neuropeptide Y/NPY	162640	NM_000905	7p15.1
	<b>Receptors</b>	Neuropeptide Y receptor Y1/NPY1R	162641	NM_000909	4q31.3-q32
		Neuropeptide Y receptor Y2/NPY2R	162642	NM_000910	4q31
		Neuropeptide Y receptor Y3/chemokine receptor	162643	X71635	2q21
		Neuropeptide Y receptor Y5/NPY5R	602001	NM_006174	4q31-q32
		Neuropeptide Y receptor Y6/NPY6R	601770	NM_006173	5q31
	<b>Biosynthesis</b>	kininogen/KNG	228960	*****	3q27
		kallikrein 1/KLK1	147910	AH002853	9q13.2-q13.4
	<b>Receptor</b>	bradykinin receptor B1/BDKRB1 G protein-coupled	600337	NM_000710	4q32.1-q32.2
		bradykinin receptor B2/BDKRB2 G protein-coupled	113503	NM_000623	4q32.1-q32.2
<b>Bradykinin</b>	<b>Catabolism</b>	X-prolyl aminopeptidase (aminopeptidase P) 2, membrane-bound/XPNPEP2	300145	NM_003399	Xq25
		carboxypeptidase N, polypeptide 1, 50kD/CPN1	603103	NM_001308	Chr.10
		carboxypeptidase N, polypeptide 2, 83kD/CPN2	603104	*****	8p23-p22

Adrenomedullin	Biosynthesis	adrenomedullin/ADM			
Angiotensin	Biosynthesis	angiotensinogen/angiotensin I/AGT	103275	NM_001124	11p15.4
		renin/REN	106150	NM_000029	1q42-q43
		renin-binding protein/RENBP	179820	NM_000537	1q32
		membrane metalloendopeptidase/MME/neutral endopeptidase	312420	NM_002910	Xq28
		thimet oligopeptidase 1/THOP1	120520	NM_000902	3q21-q27
		chymase 1, mast cell/CMA1	601117	NM_003249	19p13.3
		angiotensin converting enzyme/dipeptidyl	118938	NM_001836	14q11.2
			106180	NM_000789	17q23
		angiotensin receptor 1/AGTR1	106165	NM_000685	3q21-q25
		angiotensin receptor 1B/AGTR1B	600015	NM_004835	*****
Vasopressin	Receptors	angiotensin receptor-like 1/AGTRL1	600052	NM_005161	11q12
		angiotensin receptor-like 2/AGTRL2	601256	NM_005162	*****
		angiotensin receptor 2/AGTR2	300034	NM_000686	Xq22-q23
		X-prolyl aminopeptidase (aminopeptidase P) 2, membrane-bound/XPNPEP2			
		prolylcarboxypeptidase/PRCP	300145	NM_003399	Xq25
			176785	NM_005040	11q14
		arginine vasopressin (neurophysin II, antidiuretic hormone, diabetes insipidus, neurohypophyseal)/AVP	192340	NM_000490	20p13
		arginine vasopressin receptor 1A/AVPR1A	600821	NM_000706	12q14-q15
		arginine vasopressin receptor 1B/AVPR1B	600264	NM_000707	1q32

	arginine vasopressin receptor 2 (nephrogenic diabetes)	304800	NM_000054	Xq28
<b>Catabolism</b>	leucyl/cystinyl	151300	NM_005575	*****
<b>Biosynthesis</b>	prepro-vasoactive intestinal adenylate-cyclase activating polypeptide 1/ADCYAP1	192320	AH003029	6q26-q27
<b>Vasoactive Intestinal Peptide</b>	vasoactive intestinal peptide receptor 1/VIPR1	102980	NM_001117	18p11
	vasoactive intestinal peptide receptor 2/VIPR2	192321	NM_004624	3p22
	adenylate cyclase activating polypeptide 1 (pituitary) receptor type 1/ADCYAP1R1	601970	NM_003382	7q36.3
	atrial natriuretic peptide precursor A/NPPA	102981	NM_001118	7p14
	natriuretic peptide precursor B/NPPB	108780	X01471	1p36.2
<b>Natriuretic Peptide</b>	atrial natriuretic peptide precursor C/NPPC	600295	NM_002521	1p36.2
	natriuretic peptide receptor A/guanylate cyclase A (atrionatriuretic peptide receptor C)/NPR1	600296	D28874	2q24-qter
	natriuretic peptide receptor B, isoform a/NPR2	108960	NM_000906	1q21-q22
	natriuretic peptide receptor C/guanylate cyclase C (atrionatriuretic peptide receptor C)/NPR3	108961	NM_000907	9p21-p12
	cytochrome P450, subfamily X1B, polypeptide 2 (steroid 11-b- hydroxylase)/CYP11B2	108962	NM_000908	5p14-p12
<b>Synthesis (additional)</b>		124080	NM_000498	8q21

<b>Mineralocorticosteroids</b> (aldosterone, deoxycorticosterone)	<i>genes in steroid hormone metabolism below)</i>	sodium channel, nonvoltage-gated 1 alpha/SCNN1A	600228	NM_001038	12p13
		sodium channel, nonvoltage-gated 1, beta (Liddle syndrome)/SCNN1B	600760	NM_000336	16p13-p12
		sodium channel, nonvoltage-gated 1, gamma/SCNN1G	600761	NM_001039	16p13-p12
		mineralocorticoid receptor/MCR/nuclear receptor subfamily 3, group C, member	600983	NM_000901	4q31.1
<b>Receptor and Coactivators</b>		nuclear receptor coactivator 2/GRIP1	601993	NM_006540	*****
		oxysterol binding protein/OSBP	167040	NM_002556	11q12-q13
		sterol regulatory element binding transcription factor 1/SREBF1	184756	NM_004176	17p11.2
		sterol regulatory element binding transcription factor 2/SREBF2	600481	NM_004599	22q13
		steroid receptor coactivator 1/SRC1	602691	NM_003743	2p23
		steroid receptor RNA activator/SRA	603819	AF092038	Chr. 5
<b>Estrogens</b>	<b>Synthesis</b>	cytochrome P450, subfamily XIX (androgen aromatase)/CYP19	107910	NM_000103	15q21.1
	<b>Receptors</b>	estrogen receptor 1/ESR1	133430	NM_000125	6q25.1
		estrogen receptor 2/ESR2	601663	X99101	14q
		estrogen-related receptor	601998	NM_004451	11q12
	<b>Catabolism</b>	estrogen-related receptor beta/ESRRB	602167	NM_004452	14q24.3
		estrogen-preferring	600043	NM_005420	4q13.1
		hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 1/HSD3B1	109715	NM_000862	1p13.1

Progestins	Synthesis	Synthesis			
		hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 2/HSD3B2	201810	NM_00019 8	1p13.1
Receptors	Receptors	progesterone receptor/PGR	264080	NM_00092 6	11q22
		heat shock 90-kD protein 1, alpha subunit/HSPCA	140571	*****	1q21.2-q22
		heat shock 90-kD protein 1, beta subunit/HSPCB	140572	J04988	6p12
		FK506-binding protein 5/FKBP5	602623	NM_00411 7	*****
Androgens	Synthesis	steroid-5-alpha-reductase, alpha polypeptide 1 (3-oxo-5 alpha-steroid delta 4-dehydrogenase alpha 1)/SRD5A1	184753	NM_001047	5p15
		hydroxysteroid (17-beta) dehydrogenase 3/HSD17B3	264300	NM_000197	9q22
		cytochrome P450, subfamily XIA (cholesterol side chain cleavage)/CYP11A	118485	NM_00078 1	15q23-q24
		steroid 5-alpha-reductase 2/SRD5A2	264600	NM_000348	2p23
Mediators of Steroid Response	Receptor	androgen receptor (dihydrotestosterone receptor)/AR	313700	NM_000044	Xq11-q12
		UDP glycosyltransferase 2 family, polypeptide B17/UGT2B17	601903	NM_001077	4q13
	Catabolism	nuclear receptor coactivator 2/GRIP1	601993	NM_006540	*****
		oxysterol binding protein/OSBP	167040	NM_002556	11q12-q13
Transcription	Transcription	sterol regulatory element binding transcription factor 1/SREBF1	184756	NM_004176	17p11.2



(common to the steroid hormones)	n Factors	steroid regulatory element binding transcription factor 2/SREBF2	600481	NM_004599	22q13
		steroid receptor coactivator 1/SRC1	602691	NM_003743	2p23
		steroid receptor RNA activator/SRA	603819	AF092038	Chr. 5
		vascular endothelial growth factor/VEGFA	192240	NM_003376	6p12
Vascular Endothelial Growth Factor	Biosynthesis	vascular endothelial growth factor/VEGFB	601398	NM_003377	11q13
		vascular endothelial growth factor/VEGFC	601528	NM_005429	*****
		kinase insert domain receptor/KDR/FLK1/VEGF receptor/VEGFR	191306	AF063657	4q12
		fms-related tyrosine kinase 1 (vascular endothelial growth factor/vascular permeability factor receptor)/FLT1	165070	NM_002019	13q12
Growth Hormone	Biosynthesis	growth hormone/GH1	139250	NM_000515	17q22-q24
	Receptors	growth hormone receptor/GHR	600946	NM_000163	5p13-p12
Endothelin	Biosynthesis	endothelin 1/EDN1	131240	NM_001955	6p24-p23
		endothelin 2/EDN2	131241	NM_001956	1p34
		endothelin 3/EDN3	131242	NM_000114	20q13.2-q13.3
		endothelin converting enzyme 1/ECE1	600423	NM_001397	1p36.1
	Receptors	endothelin A receptor isoform delta 3/EDNRA	131243	AF014826	Chr. 4
		endothelin receptor type B/EDNRB	131244	NM_000115	13q22
		protein kinase C beta/PRKCB	176970	X06318	16p11.2
		transforming growth factor, beta-1/TGFB1	190180	M60315	9q13.1-q13.2

Transforming Growth Factor Beta	Biosynthesis	transforming growth factor, beta-2/TGFB2	190220	NM_003238	1q41
		transforming growth factor, beta-3/TGFB3	190230	NM_003239	14q24
Receptors		transforming growth factor, beta receptor I (activin A receptor type II-like kinase, 53kD)/TGFBRI	190181	NM_004612	9q33-q34
		transforming growth factor, beta receptor II (70-80kD)/TGFBRII	190182	NM_003242	3p22
		transforming growth factor, beta receptor III (betaglycan, 300kD)/TGFBRIII	600742	NM_003243	1p33-p32
		heparin-binding growth factor 1/FGF1	131220	NM_000800	5q31
		basic fibroblast growth factor/FGF2	134920	NM_002006	4q25-q27
		fibroblast growth factor 3/FGF3	164950	NM_005247	11q13
		HST oncogene/fibroblast growth factor 4/FGF4	164980	NM_002008	11q13
		fibroblast growth factor-related protein/FGF5	165190	NM_004464	4q21
		fibroblast growth factor 6/FGF6	134921	X57075	12p13
		keratinocyte growth factor/fibroblast growth factor 7/FGF7	148180	NM_002009	15q15-q21.1
Fibroblast Growth Factor	Biosynthesis	fibroblast growth factor 8 (androgen-induced)/FGF8	600483	NM_006119	10q24
		fibroblast growth factor 9 (glia-activating factor)/FGF9	600921	NM_002010	13q11-q12
		fibroblast growth factor 10/FGF10	602115	NM_004465	5p13-p12
		fibroblast growth factor 11/FGF11	601514	NM_004112	17q21
		fibroblast growth factor 12/FGF12	601513	*****	3q28
		fibroblast growth factor 13/FGF13	300070	NM_004114	Xq26.3

<b>Growth Factor</b>		fibroblast growth factor 14/FGF14	601515	NM_004115	13q34
		fibroblast growth factor 16/FGF16	603724	NM_003868	*****
		fibroblast growth factor 17/FGF17	603725	NM_003867	8p21
		fibroblast growth factor 18/FGF18	603726	NM_003862	*****
		fibroblast growth factor 19/FGF19	603891	NM_005117	*****
<b>Growth Factors</b>	<b>Receptors</b>	fibroblast growth factor receptor 1/FGFR1	136350	*****	8p11.2-p11.1
		fibroblast growth factor receptor 2 (bacteria-expressed kinase, keratinocyte growth factor receptor, craniofacial dysostosis 1, Crouzon syndrome, Pfeiffer syndrome, Jackson-Weiss syndrome)/FGFR2	176943	NM_000141	10q26
		fibroblast growth factor receptor 3 (achondroplasia, thanatophoric dwarfism)/FGFR3	134934	NM_005247	4p16.3
		fibroblast growth factor receptor 4/FGFR4	134935	NM_002011	5q35.1-qter
		somatostatin transcription factor 1/STF1/homeodomain transcription factor/insulin promoter factor 1/IPF1	600733	NM_000209	13q12.1
	<b>Biosynthesis</b>	paired box gene 6/PAX6	106210	NM_000280	11p13
		somatostatin/SST	182450	NM_001048	3q28
		preprocartistatin/CORT	602784	NM_001302	1p36
	<b>Somatostatin</b>	Somatostatin receptor 1/G protein-coupled/SSTR1	182451	NM_001049	14q13
		Somatostatin receptor 2/SSTR2	182452	NM_001050	17q24

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	Receptors	Somatostatin receptor 3/adenyl cyclase coupled/SSTR3	182453	NM_001051	22q13.1
		Somatostatin receptor 4/SSTR4	182454	NM_001052	20p11.2
		Somatostatin receptor 5/SSTR5	182455	NM_001053	16p13.3
Insulin	Biosynthesis	somatostatin transcription factor 1/STF1/homeodomain transcription factor/insulin promoter factor 1/IPF1	600733	NM_000209	13q12.1
		insulin/INS	176730	NM_000207	11p15.5
		sulfonylurea receptor (hyperinsulinemia)/SUR	600509	NM_000352	11p15.1
		beta-cell inward rectifier subunit/BIR/potassium inwardly-rectifying channel, subfamily J, member 11/KCNJ11	600937	D50582	11p15.1
		carboxypeptidase E/CPE	114855	NM_001873	Chr.4
		insulin receptor/INSR	147670	NM_000208	19p13.2
		insulin receptor substrate 1/IRS1	147545	NM_005544	2q36
		insulin receptor substrate 2/IRS2	600797	NM_003749	13q34
		insulin receptor substrate 4/IRS4	603510	NM_003604	*****
		amylin/diabetes-associated peptide/DAP/islet amyloid polypeptide/IAPP	147940	NM_000415	12p12.3-p12.1
	Metabolism	insulin-degrading enzyme/IDE	146680	NM_004969	10q23-q25
	Diagnosis	insulin-like growth factor 1 (somatomedin C)/IGF1	147440	M27544	12q22-q24.1

Insulin-Like Growth Factor	Receptors	insulin-like growth factor 2 (somatomedin A)/IGF2	147470	NM_000612	11p15.5
		insulin-like growth factor 1 receptor precursor/IGF1R	147370	NM_000875	15q25-q26
Insulin-Like Growth Factor	Regulation	insulin-like growth factor 2 receptor/IGF2R	147280	NM_000876	6q26
		insulin-like growth factor binding protein	146730	NM_000596	7p14-p12
		insulin-like growth factor binding protein	146731	M35410	2q33-q34
		insulin-like growth factor binding protein	146732	NM_000598	7p14-p12
		insulin-like growth factor binding protein	146733	Y12508	17q12-q21
		insulin-like growth factor binding protein	146734	AF055033	2q33-q36
		insulin-like growth factor binding protein	146735	M69054	12q13
		insulin-like growth factor binding protein	602867	NM_001553	4q12
		connective tissue growth factor/CTGF	121009	NM_001901	6q23.1
		insulin-like growth factor binding protein	602369	NM_001554	1p22.3
Catabolism		insulin-like growth factor binding protein	601489	NM_004970	Chr. 16
		protease, serine, 11 (IGF binding)/PRSS11	602194	NM_002775	0q25.3-q26.2
Angiopoietin	Biosynthesis	angiopoietin 1/ANGPT1	601667	NM_001146	8q22
		angiopoietin 2/ANGPT2	601922	NM_001147	8p21
		angiopoietin 3/ANGPT3	603874	NM_004673	*****
		angiopoietin 4/ANGPT4	603705	AF113708	20p13
		angiopoietin 5/ANGPT5	*****	AF152562	*****
Receptors		protein receptor tyrosine kinase, epithelial-specific 2/TIE2/TEK	600221	NM_000459	9p21
		tyrosine kinase, endothelial/TEK			

Platelet-Derived Growth Factor	Biosynthesis	platelet-derived growth factor alpha polypeptide/PDGFA	173430	NM_002607	7p22
		platelet-derived growth factor beta polypeptide (simian sarcoma viral (v-sis) oncogene homolog)/PDGFB	190040	NM_002608	12q12.3-q13.1
Receptors		platelet-derived growth factor receptor, alpha polypeptide/PDGFR	173490	NM_006206	4q12
		platelet-derived growth factor receptor, beta polypeptide/PDGFRB	173410	NM_002609	5q31-q32
Phosphodiesterases		phosphodiesterase 1A, calmodulin-dependent/PDE1A	171890	NM_005019	Chr.4
		phosphodiesterase 1B, calmodulin-dependent/PDE1B	171891	NM_000924	12q13
		phosphodiesterase 1C, calmodulin-dependent/PDE1C	602987	NM_005020	*****
		phosphodiesterase 3A, cGMP-inhibited/PDE3A	123805	NM_000921	11p15
		phosphodiesterase 3B, cGMP-inhibited/PDE3B	602047	NM_000922	11p15
		phosphodiesterase 5A, cGMP-specific/PDE5A	603310	NM_001083	4q26
		protein kinase, AMP-activated, alpha 1	602739	NM_006251	5p12
AMP-Activated Protein Kinases		protein kinase, AMP-activated, beta 1	602740	NM_006253	12q24.1
		protein kinase, AMP-activated, gamma	602742	NM_002733	12q13.1
		protein kinase, AMP-activated, alpha 2 catalytic subunit/PRKAA2	600497	NM_006252	1p31
		protein kinase, AMP-activated, beta 2 non-catalytic subunit/PRKAB2	602741	NM_005399	*****

	protein kinase, AMP-activated, gamma 2 non-catalytic subunit	602743	*****	7q35-q36
cGMP-Dependent Protein Kinases	protein kinase, cGMP-dependent, regulatory, type I/PRKG1	176894	D45864	10q11.2
	protein kinase, cGMP-dependent, type II/PRKG2	601591	NM_006259	4q13.1-q21.1
	protein kinase, cAMP-dependent, regulatory, type I, alpha (tissue specific extinguisher 1)/PRKAR1A	188830	NM_002734	17q23-q24
cAMP-Activated Protein Kinases	protein kinase, cAMP-dependent, regulatory, type I, beta/PRKAR1B	176911	*****	7pter-p22
	protein kinase, cAMP-dependent, regulatory, type II, alpha/PRKAR2A	176910	NM_004157	3p21.3-p21.2
	protein kinase, cAMP-dependent, regulatory, type II, beta/PRKAR2B	176912	NM_002736	7q22
	protein kinase, cAMP-dependent, catalytic, alpha/PRKACA	601639	NM_002730	19p13.1
	protein kinase, cAMP-dependent, catalytic, beta/PRKACB	176892	NM_002731	1p36.1
	protein kinase, cAMP-dependent, catalytic, gamma/PRKACG	176893	NM_002732	9q13
	guanine nucleotide binding protein (G protein), alpha 11 (Gq class)/GNA11	139313	NM_002067	19p13
	guanine nucleotide binding protein (G protein), alpha 13/GNA13	*****	NM_006572	*****
	guanine nucleotide-binding protein (G protein), alpha 14 /GNA14	*****	NM_004297	*****
	guanine nucleotide binding protein (G protein), alpha 15 (Gq class)/GNA15	139314	NM_002068	19p13

guanine nucleotide binding protein (G protein), alpha activating activity polypeptide L, olfactory type/GNAL	139312	NM_002071	18p11.22-p11.21
guanine nucleotide binding protein (G protein), alpha activating activity polypeptide O/GNAO1	139311	Y18213	16q13
guanine nucleotide binding protein (G protein), q polypeptide/GNAQ	600998	NM_002072	9q21
guanine nucleotide binding protein (G protein), alpha z polypeptide/GNAZ	139160	NM_002073	22q11.2
guanine nucleotide binding protein (G protein), beta polypeptide 1/GNB1	139380	*****	1pter-p31.2
guanine nucleotide binding protein (G protein), beta polypeptide 2/GNB2	139390	NM_005273	7q21-q27
guanine nucleotide binding protein (G protein), beta polypeptide 2-like 1/GNB2L1/RACK1	176981	NM_006098	*****
guanine nucleotide binding protein (G protein), beta polypeptide 3/GNB3	139130	NM_002075	12p13
guanine nucleotide binding protein (G protein), beta 5/GNB5	*****	NM_006578	*****
guanine nucleotide binding protein (G protein), gamma 3/GNG3	*****	AF188177	*****
guanine nucleotide binding protein (G protein), gamma 4/GNG4	*****	NM_004485	*****
guanine nucleotide binding protein (G protein), gamma 5/GNG5	600874	NM_005274	1p22
guanine nucleotide binding protein (G protein), gamma 7/GNG7	*****	NM_005145	*****

## G-Proteins

Second  
Messengers



	guanine nucleotide binding protein (G protein), gamma 8/GNG8	*****	AF188179	*****
	guanine nucleotide binding protein (G protein), gamma 10/GNG10	*****	NM_004125	*****
	guanine nucleotide binding protein (G protein), gamma 11/GNG11	*****	NM_004126	*****
	guanine nucleotide binding protein (G protein), gamma 12/GNG12	*****	AF188181	*****
<b>G-Protein Modulators</b>	guanine nucleotide binding protein (G protein), alpha stimulating activity polypeptide 1/GNAS1	139320	NM_000516	20q13.2
	guanine nucleotide binding protein (G protein), alpha inhibiting activity polypeptide 1/GNAI1	139310	NM_002069	7q21
	guanine nucleotide binding protein (G protein), alpha inhibiting activity polypeptide 2/GNAI2	139360	NM_002070	3p21
	guanine nucleotide binding protein (G protein), alpha inhibiting activity polypeptide 3/GNAI3	139370	NM_006496	1p13
	guanine nucleotide binding protein (G protein), alpha inhibiting activity polypeptide H/GNAIH	139180	*****	12p13-p12
	v-src: avian sarcoma (Schmidt-Ruppin A-2) viral oncogene homolog/SRC	190090	NM_005417	20q12-q13
	protein kinase C alpha/PRKCA	176960	NM_002737	17q22-q23.2
<b>Protein Tyrosine Kinases</b>	protein kinase C beta/PRKCB	176970	X06318	16p11.2

<b>Calcium- and Diacylglycerol-Activated Protein Kinases</b>	protein kinase C, delta/PRKCD	176977	NM_006254	3p
	protein kinase C, epsilon/PRKCE	176975	NM_005400	2p21
	protein kinase C gamma/PRKCG	176980	*****	19q13.4
	protein kinase C, iota/PRKCI	300094	NM_002740	Xq21.3
	protein kinase C, mu/PRKCM	*****	NM_002742	*****
	protein kinase C, theta/PRKCQ	600448	NM_006257	10p15
<b>(Ca<sup>++</sup>)-Calmodulin-Dependent Protein Phosphatases</b>	protein kinase C, zeta/PRK CZ	176982	NM_002744	*****
	protein phosphatase 3, catalytic subunit A, alpha isoform/PPP3CA	114105	M29550	4q21-q24
	protein phosphatase 3, catalytic subunit A, beta isoform/PPP3CB	114106	M29551	10q21-q22
	protein phosphatase 3, regulatory subunit B, alpha isoform/PPP3CB	601302	*****	2p16-p15
	mitogen activated protein kinase PRKM1/MAPK1/ERK2	176948	NM_002745	22q11.2
	mitogen activated protein kinase PRKM3/MAPK3/ERK1	601795	X60188	16p11.2
<b>Mitogen Activated Protein Kinases</b>	mitogen activated protein kinase PRKM4/MAPK4	176949	NM_002747	18q12-q21
	mitogen activated protein kinase PRKM6/MAPK6	602904	NM_002748	*****
	mitogen activated protein kinase PRKM7/MAPK7	602521	NM_002749	17p11.2
	mitogen activated protein kinase JNK1/PRKM8/MAPK8	601158	L26318	*****

**Growth Control**  
(*additional genes in Oncology*)

Kinases	mitogen activated protein kinase JNK2/PRKM9/MAPK9	602896	U09759	5q35
	mitogen activated protein kinase JNK3/PRKM10/MAPK10	602897	U35003	*****
	mitogen activated protein kinase PRKM11/MAPK11	602898	AF031135	*****
	mitogen activated protein kinase SAPK3/MAPK12	602399	NM_00296 9	22q13.3
	mitogen activated protein kinase PRKM13/MAPK13	602899	NM_00275 4	*****
	mitogen activated protein kinase SAPK2A/MAPK14	600289	NM_00131 5	6p21.3- p21.2
	BCL2	151430	M13994	18q21.3
	BCL-X/BCLX	600039	Z23115	*****
	BCL2 associated protein/BAX	600040	L22473	19q13.3- q13.4
	BCL2-antagonist/killer 1/BAK1	600516	NM_00118 8	6p21.3- p21.2
	BCL2-associated athanogene 1/BAG1	601497	NM_00432 3	9p12
	BCL2-associated athanogene 2/BAG2	603882	NM_00428 2	*****
	BCL2-associated athanogene 3/BAG3	603883	AF095193	*****
	BCL2-associated athanogene 4/BAG4	603884	AF095194	*****
	BCL2-associated athanogene 5/BAG5	603885	AF095195	*****
	BCL-X/BCL-2 binding protein/BAD	603167	AF021792	*****
	BCL2-like 1/BCL2L1	600039	NM_00119 1	*****
	BCL2-like 2/BCL2L2	601931	NM_00405 0	14q11.2- q12

BCL2-like 11 (apoptosis facilitator)/BCL2L11	603827	NM_006538	*****
BCL2-related protein A1/BCL2A1	601056	Y09397	15q24.3
BCL2-interacting protein harikari/HRK	603447	NM_003806	*****
BCL-2 interacting killer/BIK	603392	U34584	*****
v-raf-1 murine leukemia viral oncogene homolog 1/RAF1	164760	NM_002880	3p25
tumor protein p53/TP53	191170	X02469	17p13.1
superfamily, member 6/FAS/TNFRSF6	134637	NM_000043	10q24.1
nuclear factor kappa-B DNA binding subunit 1/NFKB1	164011	M58603	4q23-q24
nuclear factor kappa-B DNA binding subunit 2/NFKB2	164012	NM_002502	10q24
apoptosis-related cysteine protease 1/caspase 1/CASP1	147678	L27475	11q22.2-q22.3
apoptosis-related cysteine protease 1/caspase 1/CASP2	600639	*****	7q35
apoptosis-related cysteine protease 1/caspase 1/CASP3	600636	NM_004346	4q35, 4q33-q35.1
apoptosis-related cysteine protease 1/caspase 1/CASP4	602664	NM_004347	11q22.2-q22.3
apoptosis-related cysteine protease 1/caspase 1/CASP5	602665	NM_004347	11q22.2-q22.3
apoptosis-related cysteine protease 1/caspase 1/CASP6	601532	NM_001226	4q25-q25
apoptosis-related cysteine protease 1/caspase 1/CASP7	601761	NM_001227	10q25.1-q25.2

## Apoptosis

## Apoptosis

	apoptosis-related cysteine protease 1/caspase 1/CASP8	601763	NM_00122 8	2q33-q34
	apoptosis-related cysteine protease 1/caspase 1/CASP9	602234	*****	*****
	apoptosis-related cysteine protease 1/caspase 1/CASP10	601762	NM_00123 0	2q33-q34
	apoptosis-related cysteine protease 1/caspase 1/CASP13	603653	NM_00372 3	*****
	ADP-ribosyltransferase (NAD <sup>+</sup> ; poly (ADP-ribose) polymerase)/PARP/ADPRT	173870	NM_00161 8	1q42
	poly (ADP-ribose) glycohydrolase/PARG	603501	NM_00363 1	10q11.23
	cyclin-dependent kinase (CDK2)	116953	NM_00179 8	12q13
	cyclin-dependent kinase (CDK3)	123828	NM_00125 8	17q22-qter
	cyclin-dependent kinase (CDK4)	123829	NM_00007 5	12q14
	cyclin-dependent kinase (CDK5)	123831	NM_00493 5	7q36
	cyclin-dependent kinase (CDK6)	603368	NM_00125 9	7q21-q22
	cyclin-dependent kinase (CDK7)	601955	NM_00315 7	2p15-cen
	cyclin-dependent kinase (CDK8)	603184	NM_00126 0	13q12
	cyclin-dependent kinase (CDK9)	603251	NM_00126 1	9q34.1
	E2F transcription factor 1/E2F1	189971	M96577	20q11.2
Cell Cycle	Cell Cycle			

		E2F transcription factor 2/E2F2	NM_00409 1	600426	1p36
		E2F transcription factor 3/E2F3	NM_00194 9	600427	6p22
		E2F transcription factor 4/E2F4	NM_00195 0	600659	16q22.1
		E2F transcription factor 5/E2F5	NM_00195 1	600967	*****
		E2F transcription factor 6/E2F6	NM_00195 2	602944	*****
		transcription factor Dp-1 (E2F dimerization partner 1)/TFDP1	NM_00711 1	189902	13q34
		transcription factor Dp-2 (E2F dimerization partner 2)/TFDP2	NM_00628 6	602160	3q23
		proliferating cell nuclear antigen/PCNA	NM_00259 2	176740	20p12
		sapiens nephrin/NPHN	NM_00464 6	602716	19q13.1
		tyrosine kinase with immunoglobulin and epidermal growth factor homology domains/TIE1	NM_00542 4	600222	1p34-p33
		HMGCoA reductase/HMGCR	NM_000859	142910	5q13.3-q14
		3-hydroxy-3-methylglutaryl-Coenzyme A synthase 1	NM_002130	142940	5p14-p13
		squalene synthetase/aranesyl-diphosphate farnesyltransferase	NM_004462	184420	8p23.1-p22

General Steroid Hormone Metabolism (additional genes in Toxicology)	Anabolism	steroid-5-alpha-reductase, alpha polypeptide 1 (3-oxo-5 alpha-steroid delta 4-dehydrogenase alpha 1)/SRD5A1	184753	NM_001047	5p15
		steroid-5-alpha-reductase, alpha polypeptide 2 (3-oxo-5 alpha-steroid delta 4-dehydrogenase alpha 2)/SRD5A2	264600	NM_000348	2p23
		steroidogenic acute regulatory protein/STAR	600617	NM_000349	8p11.2
		cytochrome P450, subfamily XIA (cholesterol side chain cleavage)/CYP11A	118485	NM_000781	15q23-q24
		cytochrome P450, subfamily XVII (steroid 17-alpha-hydroxylase), adrenal hyperplasia/CYP17	202110	NM_000102	10q24.3
		hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 1/HSD3B1	109715	NM_000862	1p13.1
		hydroxy-delta-5-steroid dehydrogenase, 3 beta- and steroid delta-isomerase 2/HSD3B2	201810	NM_000198	1p13.1
		dehydroepiandrosterone (DHEA)-preferring sulfotransferase, family 2A, member 1/SULT2A1	125263	NM_003167	19q13.3
		estrogen-preferring	600043	NM_005420	4q13.1
		UDP glycosyltransferase 1/UGT1	191740	NM_001072	Chr. 12
	Catabolism	UDP glycosyltransferase family 2, member B4/UGT2B4	600067	NM_001073	4q13

Biosynthesis	UDP glycosyltransferase family 2, member B7/UGT2B7	600068	NM_001074	1q14
	UDP glycosyltransferase 2 family, polypeptide B11/UGT2B11	603064	NM_001073	*****
	UDP glycosyltransferase family 2, member B15/UGT2B15	600069	NM_001076	4q13
	UDP glycosyltransferase family 2, member B17/UGT2B17	601903	NM_001077	1q14
	acetyl-Coenzyme A carboxylase alpha/ACACA	200350	NM_000664	17q21
	acetyl-Coenzyme A carboxylase beta/ACACB	601557	NM_001093	12q24.1
	acetyl-Coenzyme A: acetyltransferase 1 (acetoacetyl Coenzyme A thiolase)/ACAT1	203750	NM_000019	11q22.3-q23.1
	acetyl-Coenzyme A: acetyltransferase 2 (acetoacetyl Coenzyme A thiolase)/ACAT2	100678	NM_005891	6q25.3-q26
	ATP citrate lyase/ACLY	108728	NM_001096	17q21.1
	glycerol-3-phosphate acyltransferase, mitochondrial/GPAM1	602395	*****	10q24-q26
	fatty acid synthase/FASN	600212	NM_004104	17q25
	apolipoprotein A1 of HDL/APOA1	107680	NM_000039	11q23
	apolipoprotein A2/APOA2	107670	NM_001643	1q21-q23
	apolipoprotein A4/APOA4	107690	NM_000482	11q23
	apolipoprotein B (including Ag(x) antigen)/APOB	107730	NM_000384	2p24



Lipid Metabolism and Storage	Transport	apolipoprotein B mRNA editing enzyme, catalytic polypeptide APOBEC1 binding protein/ABBP1/heterogeneous nuclear ribonucleoprotein A/B/HNRPAB	600130	NM_005889	12p13.1
		apolipoprotein C1/APOC1	602688	NM_004499	*****
		apolipoprotein C2/APOC2	107710	NM_001645	19q13.2
		apolipoprotein C3/APOC3	207750	NM_000483	19q13.2
		apolipoprotein C4/APOC4	107720	NM_000040	11q23
		apolipoprotein D/APOD	600745	NM_001646	19q13.2
		apolipoprotein E/APOE	107740	NM_001647	3q26.2-qter
		apolipoprotein F/APOF	107741	NM_000041	19q13.2
		apolipoprotein H (beta-2-glycoprotein I)/APOH	107760	NM_001638	Chr.12
		apolipoprotein J/clustrin/APOJ/CLU	138700	NM_000042	17q23-qter
		apolipoprotein L/APOL	185430	NM_001831	8p21-p12
		pancreatic triglyceride lipase/PNLIP	603743	AF019225	Chr. 22
		enterostatin/colipase, pancreatic/CLPS	246600	AH003527	10q26.1
		high density lipoprotein receptor/CD36 antigen (collagen type I receptor, thrombospondin receptor)-like 1/CD36L1/SRB1	120105	NM_001832	6pter-p21.1
		cubilin (intrinsic factor-cobalamin receptor) precursor/CUBN	601040	NM_005505	Chr. 12
		cholesterol efflux regulatory protein/CE	602997	NM_001081	10p12.1
		low density lipoprotein receptor (familial/hypercholesterolemia)/LDLR	600046	NM_005502	9q22-q31
		low density lipoprotein receptor-related protein 1/LRP1	143890	NM_000527	9p13.2-p13.1
			107770	NM_002332	2q13.1-q13.3

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<b>Lipid Metabolism</b>	<b>Uptake</b>	low density lipoprotein receptor-related protein 2/LRP2	600073	U33837	2q24-q31
		low density lipoprotein receptor-related protein 5/LRP5	603506	AF077820	11q13.4
		low density lipoprotein receptor-related protein 8/LRP8	602600	NM_004631	1p34
		low density lipoprotein receptor-related protein-associated protein	104225	NM_002337	4p16.3
		oxidized low density lipoprotein receptor/OLR1	602601	NM_002543	12p13-p12
		very low density lipoprotein receptor/VLDLR	192977	NM_003383	9p24
		microsomal triglyceride transfer protein large subunit/MTP	157147	NM_000253	4q22-q24
		sortilin related receptor/SORL1	602005	NM_003105	1q23.2-q24.2
		plasma cholesterol ester transfer protein/CETP	118470	NM_000078	16q21
		phospholipid transfer protein/PLTP	172425	NM_006227	20q12-q13.1
		glycerol-3-phosphate acyltransferase, mitochondrial/GPAM1	602395	*****	10q24-q26
		lipoprotein lipase/LPL	238600	NM_000237	8p22
		lipase, hepatic/LIPC	151670	NM_000236	15q21-q23
		adrenergic, beta-3-, receptor/ADRB3	109691	NM_000025	8p12-p11.2
<b>Lipid Metabolism</b>	<b>Release</b>	lysosomal acid lipase/LIPB	278000	NM_000235	10q24-q25
		lipase, hormone-sensitive/LIPE	151750	NM_005357	9q13.1-q13.2
		perilipin/PLIN	170290	NM_002666	15q26
		fatty acid binding protein 4, adipocyte/FABP4	600434	NM_001442	8q21

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Coenzyme A Ligases	Fatty acid CoA Ligase, long chain 1/FACL1	152425	*****	3q13
	Fatty acid CoA Ligase, long chain 2/FACL2	152426	*****	4q34-q35
	Fatty acid CoA Ligase, long chain 3/FACL3	602371	NM_00445 7	2q34-q35
	Fatty acid CoA Ligase, long chain 4/FACL4	300157	NM_00445 8	Xq22.3
	Fatty acid CoA Ligase, very long chain 1/FACVL1	603247	NM_00364 5	15q21.2
Ketogenesis	3-hydroxy-3-methylglutaryl- Coenzyme A synthase 2	600234	NM_00551 8	1p13-p12
	acyl-Coenzyme A dehydrogenase, long	201460	NM_001608	2q34-q35
	acyl-Coenzyme A dehydrogenase, C-4	201450	NM_000016	1p31
	acyl-Coenzyme A dehydrogenase, C-2	201470	NM_000017	12q22-qter
	carnitine palmitoyltransferase I, liver, nuclear gene encoding mitochondrial protein/CPT1A	600528	NM_001876	11q13
	carnitine palmitoyltransferase II, nuclear gene encoding mitochondrial protein/CPT2	600650	NM_000098	1p32
	carnitine/acylcarnitine	212138	NM_000387	3p21.31
	enoyl-CoA, hydratase/3-hydroxyacyl CoA dehydrogenase/EHHADH	261515	NM_00196 6	3q27
	hydroxyacyl-CoA dehydrogenase/3- ketoacyl-CoA thiolase/enoyl-CoA hydratase, alpha subunit/HADHA	600890	NM_00018 2	2p23

<b>β-Oxidation</b>	hydroxyacyl-CoA dehydrogenase/3-ketoacyl-CoA thiolase/enoyl-CoA hydratase, beta subunit/HADHB	143450	NM_000183	2p23
	acyl-Coenzyme A oxidase 1/ACOX1 (peroxisomal)	264470	NM_004035	17q25
	acyl-Coenzyme A oxidase 2, branched chain/ACOX2 (peroxisomal)	601641	NM_003500	3p14.3
	acyl-Coenzyme A dehydrogenase, C-2 to C-3 short chain precursor/ACADS (mitochondrial)	201470	NM_000017	12q22-qter
	acyl-Coenzyme A dehydrogenase, C-4 to C-12 straight chain/ACADM (mitochondrial)	201450	NM_000016	1p31
	acyl-Coenzyme A dehydrogenase, long chain/ACADL (mitochondrial)	201460	NM_001608	2q34-q35
	hydroxyacyl-Coenzyme A dehydrogenase, type II/HADH2	602057	NM_004493	*****
	enoyl-Coenzyme A hydratase 1/ECH1 (peroxisomal)	600696	NM_001398	19q13
	cystathionine-beta-synthase/CBS	236200	NM_000071	21q22.3
	cubilin (intrinsic factor-cobalamin receptor) precursor/CUBN	602997	NM_001081	10p12.1
<b>Homocysteine Metabolism</b>	betaine-homocysteine S-methyltransferase/BHMT	602888	NM_001713	*****
	5-methyltetrahydrofolate-homocysteine methyltransferase/methionine	156570	NM_000254	1q43
	S-adenosylhomocysteine hydrolase/AHCY	180960	M61832	20cen-q13.1

		methylenetetrahydrofolate reductase/MTHFR	236250	AH007464	1p36.3
Purine Nucleotide Cycle	Purine Nucleotide Cycle	adenosine monophosphate deaminase 1 (isoform M)/AMPD1	102770	NM_000036	1p21-p13
		adenylosuccinate synthase/ADSS	103060	NM_001126	1cen-q12
		adenylosuccinate lyase/ADSL	103050	NM_000026	22q13.1
		sarcoglycan, delta (35kD dystrophin-associated glycoprotein)/SGCD	601411	NM_000337	5q33
		phospholamban/PLN	172405	NM_002667	6q22.1
		desmin/DES	125660	NM_001927	2q35
		cofilin 2 (muscle)/CFL2	601443	*****	Chr. 12
		myosin heavy chain 7, cardiac muscle, beta/MYH7	160760	NM_000257	14q12
		cardiac myosin binding protein C/MYBPC3	600958	NM_000256	11p11.2
		tropomyosin 1 (alpha)/TPM1	191010	NM_000366	15q22.1
		troponin C, slow/TNNC1	191040	NM_003280	3p21.3-p14.3
		troponin I, cardiac/TNNI3	191044	NM_000363	19q13.4
		troponin T2, cardiac/TNNNT2	191045	NM_000364	1q32
Cardiac Muscle Function		elastin (supravalvular aortic stenosis, Williams-Beuren syndrome)/ELN	130160	NM_000501	7q11.2

Cardiac Muscle Structure and Metabolism	Sarcoplasmic Reticulum Function	ATPase, Ca++ transporting, cardiac muscle, fast twitch 1/ATP2A1	108730	M23114	16p12
		ATPase, Ca++ transporting, cardiac muscle, slow twitch 2/ATP2A2	108740	NM_001681	12q23-q24.1
		ryanodine receptor 2 (cardiac)/RyR2	180902	NM_001035	1q42.1-q43
		calsequestrin 2, fast twitch cardiac muscle/CASQ2	114251	NM_001232	1p13.3-p11
	Mitochondrial Function	mitochondrial tRNA-Leu (UUR)	590050	S55822	mitochondrial
		tafazzin (cardiomyopathy, dilated 3A (X-linked); endocardial fibroelastosis 2; Barth syndrome/TAZ)	300069	NM_000116	Xq28
	Receptors	focal adhesion kinase/FAK/PTK2 protein	600758	NM_005607	8q24-qter
		sapiens potassium inwardly-rectifying channel	600681	NM_000891	Chr. 17
	Channels	G-protein coupled inwardly rectifying potassium channel/GIRK/potassium inwardly-rectifying channel, subfamily J, member 3/KCNJ3	601534	NM_002239	2q24.1
		ATP sensitive potassium inwardly-rectifying channel, subfamily J, member 5/KCNJ5	600734	NM_000890	11q24
		v-Ha-ras/Harvey rat sarcoma viral oncogene homolog/HRAS	190020	NM_005343	11p15.5
		v-Ki-ras2 Kirsten rat sarcoma 2 viral oncogene homolog/KRAS2	190070	NM_004985	12p12.1
		neuroblastoma RAS viral (v-ras) oncogene homolog/NRAS	164790	NM_002524	1p13.2
		ras-related C3 botulinum toxin substrate 1	602048	NM_006908	Xq26.2-27.2
		ras-related C3 botulinum toxin substrate 2	602049	NM_002872	2q12.3-q13.2

Response to Mechanical Stress	Signaling	ras-related C3 botulinum toxin substrat	602050	NM_005052	17q24-qter
		LIM domain kinase 1/LIMK1	601329	NM_002314	7q11.23
		LIM domain kinase 2/LIMK2	601988	NM_005569	22q12
		cell division cycle 42 (GTP-binding pro	116952	NM_001791	1p36.1
		p21/Cdc42/Rac1-activated kinase 1 (yeast Ste20-related)/PAK1	602590	NM_002576	11q13-q14
		protein kinase C-like 2/PRKCL2/RAK2	602549	NM_006256	*****
	Transcription Factors	oligopherin/OPHN3/p21 (CDKN1A)-activated kinase 3/PAK3	300142	NM_002578	Xq21.3-q24
		cardiac-specific homeo box/CSX	600584	NM_004387	5q34
		GATA-binding protein 4/GATA4	600576	NM_002052	8p23.1-p22
		serum response factor (c-fos serum response element-binding transcription factor)/SRF	600589	NM_003131	*****
Growth Factors		granulocyte-macrophage colony stimulating factor 2/CSF2	138960	NM_000758	5q31.1
		macrophage-specific colony-stimulating factor/CSF1	120420	AH005300	1p21-p13
		granulocyte colony stimulating factor 3/CSF3	138970	NM_000759	17q11.2-q12
		erythropoietin/EPO	133170	NM_000799	7q21

Erythropoiesis	Receptors	flt3 ligand/FMS-related tyrosine kinase 3 ligand/FLT3LG	600007	U03858	19q13.3
		thrombopoietin (MLV oncogene ligand, megakaryocyte growth and development factor)/THPO	600044	NM_000460	3q26.3-q27
		granulocyte-macrophage colony stimulating factor 2 receptor, alpha, low-affinity/CSF2RA	306250	NM_006140	Xp22.32
		granulocyte-macrophage colony stimulating factor 2 receptor, beta/CSF2RB	138981	U18373	22q12.2-q13.1
		granulocyte-macrophage colony stimulating factor 2 receptor, alpha, Y chromosomal/CSF2RY	425000	*****	Yp11
		erythropoietin receptor/EPOR	133171	NM_000121	19p13.3-p13.2
		colony stimulating factor 1 receptor/CSFR1	164770	U63963	5q33.2-q33.3
		myeloproliferative leukemia virus oncogene/MPL/thrombopoietin receptor/TPOR	159530	NM_005373	1p34
		Janus kinase 2 (a protein tyrosine kinase)/JAK2	147796	NM_004972	9p24
		STAM-like protein containing SH3 and ITAM domains 2/STAM2	*****	NM_005843	*****
Signaling, Transcription, and Translation		ribosomal protein S7/RPS7	603474	NM_001011	19q13.2
		signal transducer and activator of transcription 5A/STAT5A	601511	NM_003152	17q11.2



Erythrocyte Production and Maintenance	Factors	BCL-X/BCLX	600039	Z23115	*****
		STAT induced STAT inhibitor 3/SSI-3	604176	NM_003955	*****
	Iron Uptake	FMS-related tyrosine kinase 3/FLT3	136351	NM_004119	13q12
		ATP-binding cassette 7 iron transporter/ABCB7	300135	NM_004299	Xq13.1-q13.3
		natural resistance-associated macrophage protein 2/NRAMP2/solute carrier family 11, member 2/SLC11A2	600523	AB015355	12q13
	Iron Transport and Storage	transferrin/TF	190000	NM_001063	3q21
		transferrin receptor (p90, CD71)/TFRC	190010	NM_003234	3q29
		transferrin receptor 2/TFR2	*****	NM_003227	*****
		iron-responsive element-binding protein 1/iron regulatory protein 1 (IRE-BP1/IREB1)	147581	M58511	Chr.9
		iron-responsive element-binding protein 2/iron regulatory protein 2 (IRE-BP2/IREB2)	147582	M58510	Chr.15
		ferritin, light polypeptide/FTL	134790	NM_000146	19q13.3-q13.4
		ferritin, heavy polypeptide 1/FTTH1	134770	NM_002032	11q12-q13
		aminolevulinate, delta-, synthase 1, nuclear gene encoding mitochondrial protein/ALAS1	301300	NM_000688	Xp11.21

<b>Heme Metabolism</b>	<b>Heme Synthesis</b>	aminolevulinate, delta-, synthase 2 (sideroblastic/hypochromic anemia), nuclear gene encoding mitochondrial protein/ALAS2	125290	NM_00003 2	3p21.1
		aminolevulinate, delta-, dehydratase/ALAD	125270	NM_00003 1	9q34
		uroporphyrinogen III synthase (congenital erythropoietic porphyria)/UROS	263700	NM_000037 5	10q25.2- q26.3
		uroporphyrinogen decarboxylase/UROD	176100	NM_000037 4	1p34
		porphobilinogen deaminase/PBGD	176000	AH002926	11q23.3
		protoporphyrinogen oxidase, nuclear gene encoding mitochondrial protein/PPOX	600923	NM_000030 9	1q22
		coproporphyrinogen oxidase (coproporphyrin, harderoporphyrin), nuclear gene encoding mitochondrial protein/CPO	121300	NM_00009 7	3q12
		ferrochelatase (protoporphyrin), nuclear gene encoding mitochondrial protein/FECH	177000	NM_00014 0	18q21.3
	<b>Hemoglobin Synthesis</b>	hemoglobin, alpha 1/HBA1	141800	NM_00051 7	16pter- p13.3
		hemoglobin, alpha 2/HBA2	141850	NM_00055 8	16pter- p13.3
		hemoglobin, beta/HBB	141900	NM_00051 8	11p15.5

<b>Heme Catabolism</b>	serum beta-glycoprotein hemoexin/HPX	142290	AH002827	11p15.5-p15.4
	inducible heme oxygenase (decycling) 1/HMOX1	141250	NM_002133	22q12
	constitutive heme oxygenase (decycling) 2/HMOX2	141251	NM_002134	16p13.3
	phenol and bilirubin UDP-glucuronosyltransferase/UDP glucosyltransferase 1/UGT1	191740	NM_001072	Chr.2
	UDP glucosyltransferase 2 family, polypeptide B4/UGT2B4	600067	AF064200	4q13
	UDP glucosyltransferase 2 family, polypeptide B7/UGT2B7	600068	NM_001074	4q13
	biliverdin reductase A/BLVRA	109750	NM_000712	7p14-cen
	biliverdin reductase B/BLVRB	600941	NM_000713	19q13.13-q13.2
	ATPase, Ca++ transporting, cardiac muscle, fast twitch 1/ATP2A1	108730	M23114	16p12
	ATPase, Ca++ transporting, cardiac muscle, slow twitch 2/ATP2A2	108740	NM_001681	12q23-q24.1
<b>Calcium</b>	ATPase, Ca++ transporting, ubiquitous/ATP2A3	601929	NM_005173	17p13.3
	ryanodine receptor 3 (brain and smooth muscle)/RYR3	180903	NM_001036	15q14-q15
	calcium channel, voltage-dependent, L type, alpha 1C subunit/CACNA1C	114205	NM_000719	12p13.3
	potassium voltage-gated channel, shaker-related subfamily, member 4/KCNKA4	176266	NM_002233	11q13.4-q14.1

Cardiac and Vascular Channels	Potassium	potassium voltage-gated channel, Isk-related family, member 1/KCNE1	176261	NM_000219	21q22.1-q22.2
		potassium voltage-gated channel, Isk-related family, member 2/KCNE2	603796	NM_005136	21q22.1
		potassium voltage-gated channel, subfamily H, member 2/KCNH2	152427	NM_000238	7q35-q36
		potassium inwardly-rectifying channel, subfamily J, member 5/KCNJ5	600734	NM_000890	11q24
		potassium voltage-gated channel precursor, KQT-like subfamily, member 1/KCNQ1	192500	NM_000218	11p15.5
	Sodium	sodium channel, nonvoltage-gated 1 alpha/SCNN1A	600228	NM_001038	12p13
		sodium channel, nonvoltage-gated 1, beta (Liddle syndrome)/SCNN1B	600760	NM_000336	16p13-p12
		sodium channel, nonvoltage-gated 1, gamma/SCNN1G	600761	NM_001039	16p13-p12
		sodium channel, voltage-gated, type V, alpha polypeptide (long (electrocardiographic) QT syndrome 3)/SCN5A	600163	NM_000335	3p24-p21
		cystic fibrosis transmembrane conductance regulator/CFTR/ATP-binding cassette, subfamily C, member 7/ABCC7	602421	NM_000492	7q31.2
	Chloride	chloride channel, calcium activated, family member 2/CLCA2	604003	NM_006536	*****
		H+-ATPase beta 1 subunit /ATP6B1	267300	AH007312	2cen-q13

Ion and Water Transport	Acidosis	solute carrier family 4, sodium bicarbonate cotransporter, member 4/SLC4A4	603345	NM_00375 9	4q21
		solute carrier family 4, sodium bicarbonate cotransporter, member 5/SLC4A5	603318	NM_00378 8	4q21
		carbonic anhydrase II/CA2	259730	NM_00006 7	8q22
		carbonic anhydrase IV/CA4	114760	NM_00071 7	17q23
		carbonic anhydrase XII/CA12	603263	AF051882	15q22
		solute carrier family 4, bicarbonate/chloride anion exchanger, member 1/SLC4A1	109270	NM_00034 2	17q21-q22
		solute carrier family 9, member A1/SLC9A1 (sodium/hydrogen ion)	107310	M81768	1p36.1-p35
		solute carrier family 9, member A2/SLC9A2 (sodium/hydrogen ion)	600530	NM_00304 8	2q11.2
		solute carrier family 9, member A3/SLC9A3 (sodium/hydrogen ion)	182307	*****	5p15.3
		solute carrier family 9 (sodium/hydrogen exchanger), isoform 3 regulatory factor 1/SLC9A3R1		NM_00425 2	
		solute carrier family 9 (sodium/hydrogen exchanger), isoform 3 regulatory factor 2/SLC9A3R2		NM_00478 5	
	Lithosis	Solute carrier family 13, member 2/SLC13A2 (dicarboxylic acids)	604148	NM_00398 4	17p11.1- q11.1

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Renal Channels	chloride channel 5/CLCN5	300008	NM_000084	Xp11.22
	chloride channel Ka, kidney/CLCNKA	602024	NM_004070	1p36
	chloride channel Kb, kidney/CLCNKB	602023	NM_000085	1p36
	solute carrier family 12 (sodium/potassium/chloride transporters), member 1/SLC12A1	600839	NM_000338	15q15-q21.1
	solute carrier family 12 (sodium/potassium/chloride transporters), member 2/SLC12A2	600840	NM_001046	5q23.3
	solute carrier family 12 (sodium/chloride transporters), member 3/SLC12A3	600968	NM_000339	16q13
	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, alpha 1 polypeptide/ATP1A1	182310	NM_000701	1p13-p11
	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, alpha 1 polypeptide-like/ATP1A1L	182360	NM_001676	13q12.1-q12.3
	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, alpha 2 polypeptide/ATP1A2	182340	NM_000702	1q21-q23
	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 1 polypeptide/ATP1B1	182330	NM_001677	1q22-q25
	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 2 polypeptide/ATP1B2	182331	X16645	17p
	ATPase, Na <sup>+</sup> /K <sup>+</sup> transporting, beta 3 polypeptide/ATP1B3	601867	NM_001679	3q22-q23
	arginine vasopressin receptor 2 (nephrogenic diabetes insipidus 2)	304800	NM_000054	Xq28
	aquaporin 1/AQP1	107776	NM_000385	7p14
	Urine Concentration			
	n			

		aquaporin 2/AQP2	107777	NM_000486	12q13
		aquaporin 3/AQP3	600170	NM_004925	9p13
		aquaporin 6/AQP6	601383	NM_001652	12q13
Vesicle Transport	Cytoskeletal Elements	adducin 1 (alpha subunit)/ADD1	102680	NM_001119	4p16.3
		adducin 2 (beta subunit)/ADD2	102681	AF001597	2p14-p13
		adducin 3 (gamma subunit)/ADD3	601568	D67031	10q24.2-q24.3
Gap Junctions	Gap Junctions	gap junction protein, alpha 1, 43kD (connexin 43)/GJA1	121014	NM_000165	6q21-q23.2
		gap-junction protein alpha 3, 46kD (connexin 46)/GJA3	121015	AF075290	13q11-q12
		gap junction protein, alpha 4, 37kD (connexin 37)/GJA4	121012	NM_002060	1p35.1
		gap junction protein, alpha 5, 40kD (connexin 40)/GJA5	121013	NM_005266	1q21.1
		gap junction protein, alpha 7, 45kD (connexin 45)/GJA7	*****	NM_005497	*****
		gap junction protein, alpha 8, 50kD (connexin 45)/GJA8	600897	NM_005267	1q21.1
		gap junction protein, beta 1, 32kD (connexin 32, Charcot-Marie-Tooth neuropathy, X-linked)/GJB1	304040	NM_000166	Xq13.1
		gap junction protein, beta 2, 26 kD (connexin 26)/GJB2	121011	M86849	13q11-q12

	gap junction protein, beta 3, 31 kD (connexin 31)/GJB3	603324	AF052692	1p35.1
	gap junction protein, beta 5, 31.1 kD (connexin 31.1)/GJB5	*****	AF052693	*****
	gap junction protein, beta 6 (connexin 30)/GJB6	*****	NM_00678 3	*****
brin Formati	factor I/fibrinogen a, alpha/FGA	134820	NM_000508	4q28
	factor I/fibrinogen b, beta/FGB	134830	AH003492	4q28
	factor I/fibrinogen g, gamma/FGG	134850	NM_000509	4q28
	factor II/prothrombin/F2	176930	F2	11p11-q12
	coagulation factor II (thrombin) receptor/F2R	187930	NM_001992	5q13
	coagulation factor II (thrombin) receptor-like 2/F2RL2	601919	NM_004101	5q13
	coagulation factor II (thrombin) receptor-like 3/F2RL3	602779	NM_003950	19p12
	tissue factor/factor	134390	NM_001993	1p22-p21
	tissue factor pathway inhibitor (lipoprotein-associated coagulation inhibitor)/TFPI	152310	NM_006287	2q31-q32.1
	tissue factor pathway inhibitor	600033	NM_006528	7q22
	factor V/proaccelerin/labile factor/F5	227400	NM_000130	1q23
	factor VII/serum prothrombin conversion accelerator/F7	227500	NM_000131	13q34
	factor VIII/antihemophilic factor/F8	306700	NM_000132	Xq28
	factor IX/Christmas factor/plasma thromboplastic component/hemophilia	306900	NM_000133	Xq27.1-q27.2
	factor X/Stuart factor/F10	227600	NM_000504	13q34
	factor XI/plasma thromboplastin antecedent/F11	264900	NM_000128	4q35

Clotting



Thrombus Formation	factor XII/Hageman factor/F12	234000	NM_000505	5q33-qter
	factor XIIIa1/fibrin-stabilizing factor/F13A1	134570	NM_000129	6p25-p24
	factor XIIIb/fibrin-stabilizing prekallikrein/Fletcher factor/kallikrein 3, plasma /KLK3	134580	*****	1q31-q32.1
	kininogen/Flaujeac factor/KNG	229000	NM_000892	4q35
	protein S (alpha)/PROS1	228960	NM_000893	3q27
	protein C (inactivator of coagulation factors Va and VIIIa)/PROC	176880	NM_000313	p11.1-q11.2
	antithrombin III/AT3	176860	NM_000312	2q13-q14
	gamma-glutamyl carboxylase/GGCX		NM_000488	1q23-q25
	plasminogen/PLG	137167	NM_000821	2p12
	monocyte antigen CD87/plasminogen activator receptor, urokinase type/PLAUR/CD87	173350	NM_000301	6q26
	plasminogen activator,	173391	NM_002659	19q13
	plasminogen activator-tissue/PLAT	191840	NM_002658	10q24
	plasminogen activator inhibitor, type I (arginine-serpin)/PAI1	173370	A07197	8p12
	plasminogen activator inhibitor, type II (arginine-serpin)/PAI2	173360	X12701	7q21.3-q22
	integrin, alpha 2b (platelet glycoprotein IIb of IIb/IIIa complex, antigen CD41B)/ITGA2B	173390	NM_002575	18q21.3
	integrin beta chain, beta 3 (platelet glycoprotein IIIa of IIb/IIIa complex, antigen CD61)/ITGB3	273800	NM_000419	17q21.32
		173470	NM_000212	17q21.32

Adhesion	Clot Adherence	glycoprotein Ib (platelet), alpha polypeptide/GPIBA	231200	NM_000173	17pter-p12
		glycoprotein IX (platelet)/GP9	173515	NM_000174	3q21
		calcium and integrin binding protein/CIB	602293	U82226	15q25.3-q26
		thrombospondin 1/THBS1	188060	NM_003246	15q15
		thrombospondin 2/THBS2	188061	NM_003247	6q27
		thrombospondin 3/THBS3	188062	NM_007112	1q21
		thrombospondin 4/THBS4	600715	NM_003248	5q13
		small inducible cytokine subfamily A (Cys-Cys), member 2/monocyte chemotactic protein 1/MCP1/SCYA2	158105	NM_002982	17q11.2-q12
		macrophage-specific colony-stimulating factor/CSF1	120420	AH005300	1p21-p13
		interleukin 1 alpha/IL1A	147760	M15329	2q14
		interleukin 1 beta/IL1B	147720	AF043335	2q14
		apoptosis-related cysteine protease 1/interleukin 1-beta converting enzyme/ICE/caspase 1/CASP1	147678	NM_001223	11q22.2-q22.3
		interleukin 2/IL2	147680	X01586	4q26-q27
		interleukin 3/IL3	147740	NM_000588	5q31.1
		interleukin 4/IL4	147780	NM_000589	5q31.1

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interleukin 5/IL5	147850	NM_000879	5q31.1
interleukin 6/IL6	147620	AF048692	7p21
interleukin 7/IL7	146660	NM_000880	8q12-q13
interleukin 8/IL8	146930	M26383	4q12-q13
interleukin 9/IL9	146931	X17543	5q31.1
interleukin 10/IL10	124092	M57627	1q31-q32
interleukin 11 beta/IL11B	147681	NM_000881	19q13.3-q13.4
interleukin 12A (natural killer cell stimulatory factor 1, cytotoxic lymphocyte maturation factor 1, p35)/IL12A	161560	NM_002187	3p12-q13.2
interleukin 12B/IL12B	161561	NM_000440	5q31.1-q33.1
interleukin 13/IL13	147683	NM_002188	5q31
interleukin 15/IL15	600554	U14407	4q31
interleukin 16/IL16	603035	NM_004513	*****
interleukin 17 (cytotoxic T-lymphocyte-associated serine esterase 3)/IL17	603149	NM_002190	2q31
interleukin 18 (interferon-gamma-inducing factor)/IL18	600953	NM_001562	11q22.2-q22.3
interleukin 1 receptor, type 1/IL1R1	147810	NM_000877	2q12
interleukin 1 receptor, type 2/IL1R2	147811	NM_004633	2q12-q22

Cytokines  
and  
Cytokine  
Receptors

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interleukin 1 receptor-like 2/IL1RL2	*****	NM_003854	*****
interleukin 1 receptor accessory protein/IL1RAP	602626	NM_002182	3q28
B-cell antigen CD25/interleukin 2 receptor, alpha chain/IL2RA/CD25	147730	10p15-p14	10p15-p14
interleukin 2 receptor, beta/IL2RB	146710	NM_000878	22q11.2-q13
interleukin 2 receptor, gamma chain/IL2RG	308380	NM_000206	Xq13
interleukin 3 alpha receptor/IL3RA	308385	M74782	Xp22.3
interleukin 4 receptor precursor/IL4R	147781	NM_000418	16p12.1-p11.2
interleukin 5 receptor alpha/IL5RA	147851	M96652	3p26-p24:
interleukin 6 receptor/IL6R	147880	NM_000565	1q21
interleukin 7 receptor/IL7R	146661	NM_002185	5p13
interleukin 9 receptor/IL9R	300007	NM_002186	Xq28
interleukin 10 receptor, alpha/IL10RA	146933	NM_001558	11q23.3
interleukin 10 receptor beta/IL10RB	*****	NM_000628	*****
interleukin receptor 11 alpha/IL11RA	600939	NM_004512	9p13
interleukin 12 receptor, beta 1/IL12RB1	600939	NM_005553	9p13
interleukin 12 receptor, beta 2/IL12RB2	601642	NM_001559	1p31.2

Cell-Mediated Inflammation

	interleukin 13 receptor, alpha 1/IL13RA1	300119	NM_001560	Chr.X
	interleukin receptor 13 alpha2/IL13A2	300130	X95302	Xq24
	interleukin 15 receptor, alpha/IL15RA	601070	NM_002189	10p15-p14
	interleukin 18 receptor 1/IL18R1	*****	NM_003855	*****
Scavenger Receptors	CD36/thrombospondin receptor/platelet collagen	173510	NM_000072	7q11.2
	CD36 antigen (collagen type I receptor; thrombospondin receptor)-like 1/CD36L1/SRB1	601040	NM_005505	Chr. 12
	CD5 antigen-like (scavenger receptor cysteine rich family)/CD5L	602592	NM_005894	1q21-q23
	acetyl LDL receptor/scavenger receptor expressed by endothelial	*****	NM_003693	*****
	macrophage scavenger receptor 1/MSR1	153622	NM_002445	8p22
	macrophage scavenger receptor 1-like/MSRL1	602728	*****	8p21
	macrophage scavenger receptor type III/SRA	153618	NM_002438	10p13
	mannose receptor, C type 1/MRC1	*****	NM_006039	*****
	endocytic receptor (macrophage mannose receptor family) (KIAA0709)	*****	NM_006039	*****
	toll-like receptor 1/TLR1	601194	NM_003263	4p14
	toll-like receptor 2/TLR2	603028	NM_003264	4q32
	toll-like receptor 3/TLR3	603029	NM_003265	4q35
	toll-like receptor 4/TLR4	603030	NM_003266	9q32-q33
	toll-like receptor 5/TLR5	603031	NM_006068	1q41-q42
Inflammatory Response				

(additional genes in Inflammation )	collectin 34	*****	AB002631	*****
	liver collectin 1/CL-L1	*****	NM_006438	*****
	collectin receptor/complement component C1q receptor/C1QR	120577	*****	
	surfactant, pulmonary-associated protein D/SFTPD	178635	NM_003019	10q23.3
	surfactant, pulmonary-associated protein A1/SFTPA1	178630	NM_005411	0q22.2-q23.1
	myeloperoxidase/MPO	254600	J02694	17q23.1
Inflammatory Superoxide Generation	eosinophil peroxidase/EPX	131399	NM_000502	*****
	PHOX22/cytochrome b-245, alpha polypeptide/CYBA	233690	NM_000101	16q24
	cytochrome b-245, beta polypeptide (chronic granulomatous disease)/CYBB	306400	NM_000397	Xp21.1
	PHOX47/soluble oxidase component II/SOC2/neutrophil cytosolic factor 1/NCF1	233700	NM_000265	7q11.23
	PHOX67/neutrophil cytosolic factor 2/NCF2	233710	NM_000433	1q25
	PHOX40/neutrophil cytosolic factor 4/NCF4	601488	NM_000631	22q13.1
	B-cell antigen CD54/intercellular adhesion molecule 1/ICAM1/CD54	147840	NM_000201	19p13.3- p13.2
	receptor for advanced glycation end products/RAGE/AGER	600214	AJ133822	6p21.3
Adhesion	integrin, alpha 7/ITGA7	600536	NM_002220	12q13
	integrin, alpha 8/ITGA8	604063	L36531	*****

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integrin, alpha 9/ITGA9	603963	L24158	3p21.3
antigen CD29/integrin, beta-1/CD29/ITGB1	135630	NM_002211	10p11.2
vascular cell adhesion molecule 1/VCAM1	192225	NM_001078	1p32-p31
complement component 1, R subcomponent/C1R	216950	NM_001733	12p13
complement component 1, S subcomponent/C1S	120580	NM_001734	12p13
complement component 1, Q subcomponent, alpha polypeptide/C1QA	120550	*****	1p36.3-p34.1
complement component 1, Q subcomponent, beta polypeptide/C1QB	120570	*****	1p36.3-p34.1
complement component 1, Q subcomponent, gamma polypeptide/C1QG	120575	*****	1p36.3-p34.1
complement component 1, Q subcomponent binding protein/C1QBP	601269	NM_001212	17p13.3
complement component 1 inhibitor (angioedema, hereditary)/C1INH	106100	NM_000062	11q11-q13.1
complement component 2/C2	217000	NM_000063	6p21.3
complement component 3/C3	120700	NM_000064	19p13.3-p13.2
complement component 4B/C4B	120820	NM_000592	6p21.3
complement component 5/C5	120900	NM_001735	9q34.1

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complement component 6/C6	217050	NM_000065	5p13
complement component 7/C7	217070	NM_000587	5p13
complement component 8, alpha polypeptide/C8A	120950	NM_000562	1p32
complement component 8, beta polypeptide/C8B	120960	NM_000066	1p32
complement component 8, gamma polypeptide/C8G	120930	NM_000606	9q34.3
complement component 9/C9	120940	NM_001737	5p13
complement factor H/H factor 1/HF1	134370	NM_000186	1q32
I factor (complement)/IF	217030	NM_000204	4q25
decay-accelerating factor for complement/DAF/CD55	125240	S72858	1q32
perforin 1/preforming protein/PRF1	170280	NM_005041	10q22
leukocyte antigen p18-20/protectin/CD59	107271	M95708	11p13
T-cell antigen CD46/membrane cofactor protein/MCP/measles virus receptor/CD46	120920	Y07713	1q32
erythrocyte antigen CD55/decay-accelerating factor for complement/DAF/CD55	125240	S72858	1q32
leukocyte antigen p18-20/protectin/CD59	107271	M95708	11p13

**Classical  
Pathway**

**Complement**



Alternative Pathway	erythrocyte antigen (CD35/complement receptor CR1 (receptor for components C3b/C4b)/CD35/CR1	120620	AH002679	1q32
	complement component 3a receptor 1/C3AR1	*****	NM_004054	*****
	complement component 4-binding protein, alpha/C4BPA	120830	NM_000715	1q32
	complement component 4-binding protein, beta/C4BPB	120831	NM_000716	1q32
	complement component 5 receptor 1 (C5a ligand)/C5AR1	113995	NM_001736	Chr.19
	antigen CD21/CD21	*****	X98257	*****
	B-factor, properdin/BF	138470	NM_001710	6p21.3
	properdin P factor, complement/PFC	312060	NM_002621	Xp11.4-p11.23
	adipsin/complement factor D precursor/DF	134350	NM_001928	*****
	phospholipase A2 group	172411	NM_000300	1p35
Phospholipase	phospholipase A2 group IB/PLA2G1B	172410	NM_000928	12q23-q24.1
	phospholipase A2 group X/PLA2G10	603603	NM_003561	16p13.1-p12
	phospholipase A2 group IVA/PLA2G4A	600522	U08374	1q25
	phospholipase A2 group VI/PLA2G6	603604	AF064594	22q13.1
	phospholipase A2 group IVC/PLA2G4C	603602	NM_003706	chr. 19
	phospholipase A2 group V/PLA2G5	601192	NM_000929	1p36-p34
	phospholipase C, beta 2/PLCB2	604114	NM_004573	15q15
	phospholipase C, beta 3/PLCB3	600230	U26425	11q13

Release of Membrane Lipids (common to PAF, leukotriene, and prostaglandin pathways)	phospholipase C, beta 4/PLCB4	600810	NM_000933	20p12
	phospholipase C, delta 1/PLCD1	602142	NM_006225	3p22-p21.3
	phospholipase C, epsilon/PLCE	600597	NM_006226	2q33
	phospholipase C, gamma 1 (formerly subtype 148)/PLCG1	172420	NM_002660	20q12-q13.1
	phospholipase C, gamma 2 (phosphatidylinositol-specific)/PLCG2	600220	NM_002661	16q24.1
	phospholipase D1, phosphatidylcholine-specific/PLD1	602382	NM_002662	3q26
	phospholipase D2/PLD2	602384	NM_002663	17p13.1
	lysosomal acid lipase/LIPB	278000	NM_000235	10q24-q25
	lipocortin 1/annexin 1/ANXA1	151690	V00546	9q11-q22
	lipocortin 2/annexin 2/ANXA2	151740	D00017	15q21-q22
Annexins	lipocortin 3/annexin 3/ANXA3	106490	M20560	4q21
	lipocortin 5/annexin 5/ANXA4	131230	NM_001154	4q26-q28
	lipocortin 7/annexin 7/ANXA1	186360	NM_004034	10q21.1-q21.2
	arachidonate 12-lipoxygenase, 12R type/ALOX12B	603741	NM_001139	17pter-p13.1
Arachidonate Metabolism	arachidonate 15-lipoxygenase/ALOX15	152392	NM_001140	17p13.3
	arachidonate 15-lipoxygenase, second type/ALOX15B	603697	NM_001141	*****
	prostaglandin endoperoxide synthetase 1/COX1/PTGS1	176805	AH001520	9q32-q33.3
	prostaglandin endoperoxide synthetase 2/COX2/PTGS2	600262	NM_000963	1q25.2-q25.3
	thromboxane A synthase 1/TBXAS1	274180	EG_D34613	7q34

Vasoactive Mediators of Inflammation	Biosynthesis	prostaglandin D2 synthase (hematopoietic)	602598	*****	*****
		prostaglandin D2 synthase (21kD, brain)/PTGDS	176803	M61900	*****
		prostaglandin I2 synthase/prostacyclin synthase/PTGIS	601699	EG_D83393	20q13
	Prostaglandins	prostaglandin E receptor 1, EP1 subtype/PTGER1	176802	NM_000955	19p13.1
		prostaglandin E receptor 2, EP2 subtype/PTGER2	176804	*****	5p13.1
		prostaglandin E receptor 3, EP3 subtype/PTGER3	176806	NM_000957	1p31.2
		prostaglandin E receptor 4, EP4 subtype/PTGER4	601586	NM_000958	5p13.1
		prostaglandin F receptor/PTGFR	600563	L24470	1p31.1
		prostaglandin F2 receptor negative regulator/PTGFRN	601204	U26664	1p13.1-q21.3
		prostaglandin I2 receptor/PTGIR/prostacyclin receptor	600022	SEG_HUMIF	19q13.3
		thromboxane A2 receptor/TBXA2R	188070	NM_001060	19p13.3
		solute carrier family 21 (prostaglandin transporter), member 2/SLC21A2	601460	NM_005630	3q21
		15-hydroxyprostaglandin dehydrogenase/HPGD	601688	NM_000860	4q34-q35
	Catabolism	aldo-keto reductase family 1, member C2/AKR1C2	600450	NM_001353	10p15-p14
		arachidonate 5-lipoxygenase/ALOX5	152390	NM_000698	Chr.10

Leukotrienes	Synthesis	arachidonate 5-lipoxygenase-activating protein/FLAP/ALOX5AP	603700	NM_001629	13q12
		leukotriene A4 hydrolase/LTA4H (aminopeptidase)	151570	NM_000895	12q22
		leukotriene C4 synthase/LTC4S	246530	NM_000897	5q35
		Gamma-glutamyltranspeptidase 1/GGT1	231950	J04131	22q11.1-q11.2
		Gamma-glutamyltranspeptidase 2/GGT2	137181	AH002728	22q11.1
	Receptors	Gamma-glutamyltransferase-like activity 1/GGTLA1	137168	NM_004121	*****
		cysteinyl leukotriene receptor 1/CYSLT1	300201	NM_006639	Xq13-q21
		leukotriene b4 receptor (chemokine receptor-like 1)/LTB4R	601531	NM_000752	14q11.2-q12
		renal microsomal dipeptidase/DPEP1	179780	NM_004413	16q24.3
		CDP-choline:alkylacetyl glycerol cholinephosphotransferase	*****	*****	*****
Platelet Activating Factor (PAF)	Receptors	platelet activating factor receptor/PTAFR	173393	M88177	1p35-p34.3
		platelet activating factor acetylhydrolase 1/PAFAH1	601690	NM_005084	6p21.2-p12
		platelet activating factor acetylhydrolase, isoform 1B, alpha	601545	NM_000430	17p13.3
		platelet activating factor acetylhydrolase, isoform 1B, beta	602508	NM_002572	11q23
		platelet activating factor acetylhydrolase, isoform 1B, gamma	603074	NM_002573	19q13.1
	Catabolism	platelet activating factor acetylhydrolase 2/PAFAH2	601545	NM_000430	17p13.3
		platelet activating factor acetylhydrolase, isoform 1B, alpha	601545	NM_000430	17p13.3
		platelet activating factor acetylhydrolase, isoform 1B, beta	602508	NM_002572	11q23
		platelet activating factor acetylhydrolase, isoform 1B, gamma	603074	NM_002573	19q13.1
		platelet activating factor acetylhydrolase, isoform 1B, gamma	603074	NM_002573	19q13.1

Amelioration of Oxidative Stress	Antioxidants and Free Radical Scavengers	Antioxidants and Free Radical Scavengers	platelet activating factor acetylhydrolase 2/PAFAH2	602344	NM_00043 7	*****
			superoxide dismutase 1/SOD1	147450	NM_000454	21q22.1
			superoxide dismutase 2, mitochondrial	147460	X65965	6q25.3
			glutamate-cysteine ligase (gamma- glutamylcysteine synthetase), catalytic (72.8kD)/GLCLC	230450	NM_00149 8	6p12
			glutathione synthetase/GSS	601002	NM_00017 8	20q11.2
			catalase/CAT	115500	NM_001752	11p13
			glutathione peroxidase 1/GPX1	138320	AF029317	3p21.3
			glutathione peroxidase 2 (gastrointestinal)/GPX2	138319	NM_00208 3	14q24.1:
			glutathione peroxidase 3 (plasma)/GPX3	138321	NM_00208 4	5q32-q33.1
			glutathione peroxidase 4 (phospholipid hydroperoxidase)/GPX4	138322	NM_00208 5	19p13.3
	Prevention of Lipid Oxidation	Prevention of Lipid Oxidation	glutathione peroxidase 5 (epididymal androgen-related protein)/GPX5	603435	NM_00150 9	*****
			ATX1 (antioxidant protein 1, yeast)	602270	NM_00404 5	5q32-q33
			homolog 1/ATOX1	152200	NM_005577	6q27
			apolipoprotein (a), Lp(a)/LPA	168820	NM_00044 6	7q21.3
			paraoxonase 1/PON1 (arylesterase)	602447	NM_00030 5	7q21.3
			paraoxonase 2/PON2	602720	L48516	7q21.4
			paraoxonase 3/PON3	152200	NM_00557 7	6q27
			apolipoprotein, Lp(a)/LPA			

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Table 7. Neurological and Psychiatric Disease Indications		Amyotrophic Lateral Sclerosis	Multiple Sclerosis	Dementia	Parkinson's Disease	Huntington's Disease	Epilepsy	Spasticity
Neuro-transmitters	storage							
	release							
	glutamate							
	serotonin							
	dopamine							
	epinephrine and norepinephrine							
	acetylcholine							
	histamine							
	adenosine							
	GABA							
	glycine							
	taurine							
	melatonin							
	nitric oxide							
	peptide hormone processing							
	opioids							
	oxytocin							
	cholecystokinin							
	neuropeptide Y							
	leptin							
	neurotensin							
	tachykinin							
	bradykinin							

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Table 7. Neurological and Psychiatric Disease Indications

Table 1. Neurological and Psychiatric Disease Indications						
Pathway	Anxiety	Depression	Schizophrenia	Migraine	Ischemic Cerebrovascular Disease	Neuralgia and Pain
storage						
release						



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Cellular Growth, Differentiation, n, and Maintenance	protein maturation and degradation								
	second messenger cascade								
	growth, differentiation, and apoptosis								
	cytoskeleton								
	secretion								
	adhesion								
	amyloid processing								
	lipid transport and metabolism								
	myelination								
	folate metabolism								

### Table 8. Toxicological Indication

		Table 8. Toxicological Indication					
		Efficacy	Safety				
Pathway			Pruritus Dyscrasia	Cutaneous Toxicity	Systemic Toxicity	CNS Toxicity	Hepatic Toxicity
Absorption and Distribution	Gastrointestinal Drug Metabolism						
	Drug Binding						
Phase I Drug Metabolism (oxidation and reduction)	Drug Transport						
	Monooxygenases ( <i>mixed function oxidases</i> )						
	General Oxidases						
	Dehydrogenases						
	Fatty Acid b-Oxidation Reduction						

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### Table 8. Toxicological Indication

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Table 9. Inflammatory Indication								
	Pathway	Arthritis	Asthma	Chronic Obstructive Pulmonary Disease	Autoimmune Disease	Inflammatory Bowel Disease	Immuno suppression	Inflam- mation
Discrimination (Self vs Non-Self)	Antigen Presentation and Recognition							

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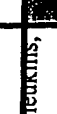
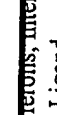
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### Table 9. Inflammatory Indication

	Pathway	Nephritis	Psoriasis	Atherosclerosis
Immune Discrimination (Self vs Non-Self)	Antigen Presentation and Recognition			
Cytokine-Mediated Immune Regulation	Interferons, Interleukins, TNF Ligand Superfamily, Chemokine Superfamily, and other Cytokines			
Non-	Cyclophilins			



Cytokine Mediated Immune Regulation	Corticosteroids				
	Testosterone/DHT				
	Vitamin D				
	Retinoic Acid				
	1-Cer, D-Cer, and Myeloid Progenitor Cell Activation, Differentiation, and Proliferation (excluding genes from cytokine action above)				
Cell-Mediated Inflammation	Apoptosis (additional genes in Oncology)				
	Adhesion and Migration				
	Glycosyltransferases				
	Proteases and Protease Inhibitors				
	Phagocytosis of Pathogens				
Defense Proteins and Peptides	Immunoglobulin Heavy and Light Chains and Genes Involved in Rearrangement, Isotype Switching, and Transcription				
	Complement				
	Acute Protection from Pathogens				

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Small Molecule Mediators of Inflammation	Degranulation of Platelets, Mast Cells, Neutrophils, and Eosinophils			
	Release of Membrane Lipids (common to PAF, leukotriene, and prostaglandin pathways)			
	Prostaglandins			
	Platelet Activating Factor (PAF)			
	Lipoxins			
	Leukotrienes			
	Histamine			
	Serotonin			
	Nitric Oxide Pathway			
	Endothelial Growth			
Vascularization				
Neurotransmitter and Peptide Hormones	Epinephrine and Norepinephrine Pathway			
	Dopamine Pathway			
	Adenosine Pathway			
	Acetylcholine Pathway			
	Ion Channels			
	Opioids			
	Leptin			
	Cholecystokinin (CCK)			

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Inflammation Inflammatory Modulation	Tachykinin, Substance P, or Neurokinin Pathway				
	Bradykinin				
	Parathyroid Hormone (PTH)				
	Melanocortin and Adrenocorticotrophic Hormone				
General Cell Growth	Folate Metabolism				
	Nucleotide Metabolism				
	Cytoskeleton				
	Oxygen Stress (additional genes in Toxicology)				

Table 10. Metabolic or Endocrinologic Indication							
Pathway	Diabetes Mellitus	Diabetes Insipidus	Obesity	Contra-ception	Hormonal Insufficiency Related to Aging	Osteo-porosis	Acne
General Metabolism for Peptide Hormones							
Peptide Hormone Control of Metabolism							
Circadian Regulation							
Adrenocorticotrophic Hormone							
Thyroid Hormone							
Gonadotropic Hormones							

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Page 720

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Table 10. Metabolic or Endocrinologic

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General Metabolism for Peptide Hormones	Pathway	Alopecia	Adrenal Dysfunction	Thyroid Dysfunction	Parathyroid Dysfunction
Peptide Hormone Control of Metabolism	Peptide Hormone Processing				
	Circadian Regulation				
	Adrenocorticotrophic Hormone				
	Thyroid Hormone				
Steroid Hormones	Gonadotrophic Hormones				
	Progestins				
	Estrogens				
	Androgens				
	Glucocorticoids				
	Mineralocorticoids				
Neural Regulation of Appetite	Mediators of Steroid Response				
	Serotonin				
	Dopamine				
	Norepinephrine				
Peptide	Neuropeptide Y				
	Galanin				
	Melanocortin				
	Opioids				
	Cholecystokinin				

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Page 723

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